


# **Soil Survey of**



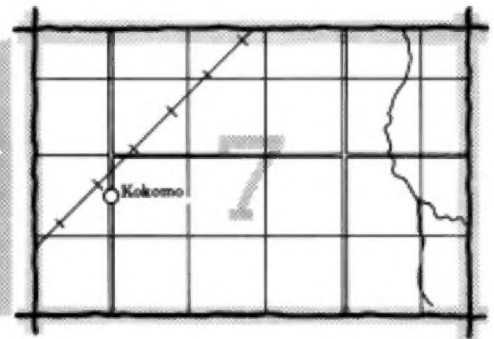
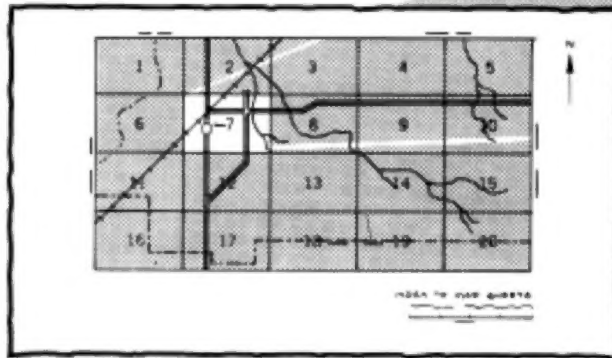
# **Douglas County,**

# **South Dakota**

United States Department of Agriculture  
Soil Conservation Service  
In cooperation with the  
South Dakota Agricultural Experiment Station

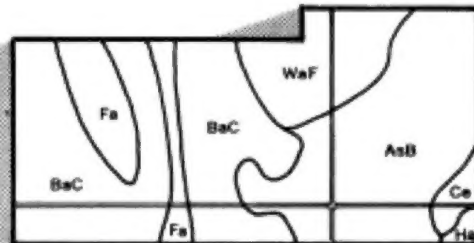
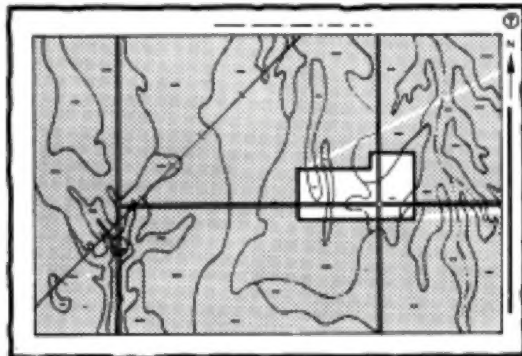
# HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

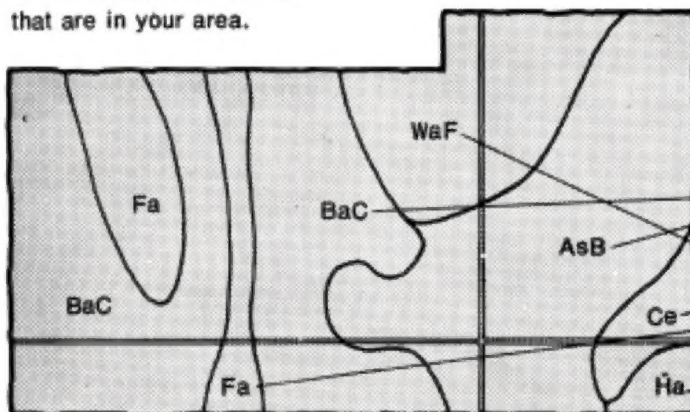


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



4. List the map unit symbols that are in your area.

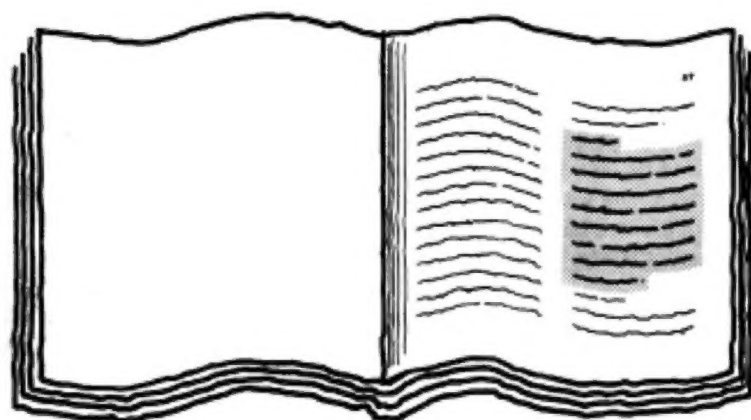


## Symbols

AsB  
BaC  
Ce  
Fa  
Ha  
WaF

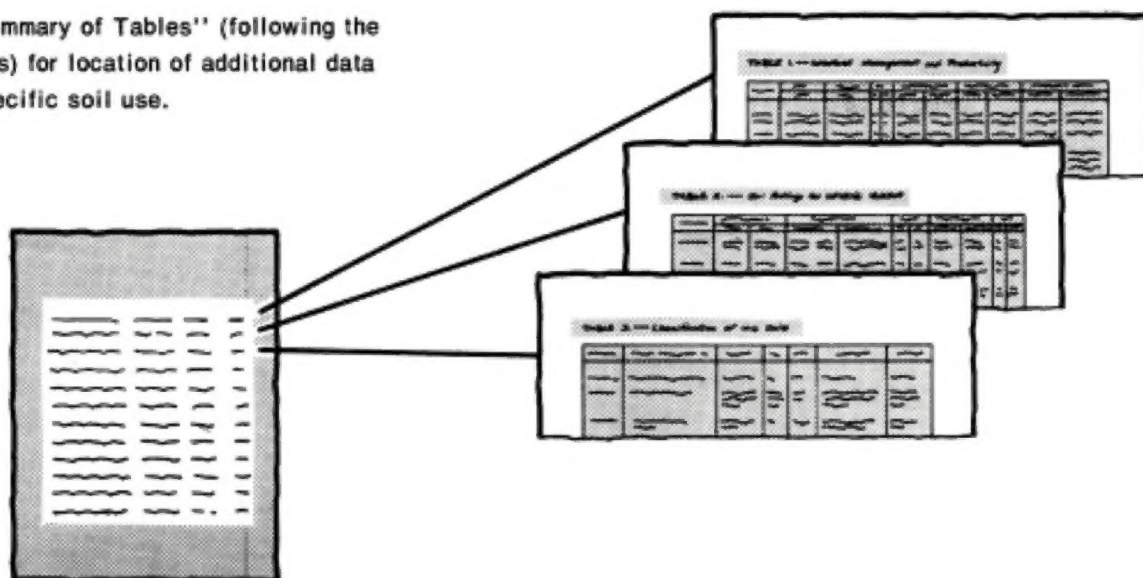
# THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



Soil Map Units	
1. 1000000000	1000000000
2. 1000000000	1000000000
3. 1000000000	1000000000
4. 1000000000	1000000000
5. 1000000000	1000000000
6. 1000000000	1000000000
7. 1000000000	1000000000
8. 1000000000	1000000000
9. 1000000000	1000000000
10. 1000000000	1000000000
11. 1000000000	1000000000
12. 1000000000	1000000000
13. 1000000000	1000000000
14. 1000000000	1000000000
15. 1000000000	1000000000
16. 1000000000	1000000000
17. 1000000000	1000000000
18. 1000000000	1000000000
19. 1000000000	1000000000
20. 1000000000	1000000000
21. 1000000000	1000000000
22. 1000000000	1000000000
23. 1000000000	1000000000
24. 1000000000	1000000000
25. 1000000000	1000000000
26. 1000000000	1000000000
27. 1000000000	1000000000
28. 1000000000	1000000000
29. 1000000000	1000000000
30. 1000000000	1000000000
31. 1000000000	1000000000
32. 1000000000	1000000000
33. 1000000000	1000000000
34. 1000000000	1000000000
35. 1000000000	1000000000
36. 1000000000	1000000000
37. 1000000000	1000000000
38. 1000000000	1000000000
39. 1000000000	1000000000
40. 1000000000	1000000000
41. 1000000000	1000000000
42. 1000000000	1000000000
43. 1000000000	1000000000
44. 1000000000	1000000000
45. 1000000000	1000000000
46. 1000000000	1000000000
47. 1000000000	1000000000
48. 1000000000	1000000000
49. 1000000000	1000000000
50. 1000000000	1000000000

6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



Consult "Contents" for parts of the publication that will meet your specific needs.

7. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

---

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Douglas County Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue, the Douglas County Commissioners, and the Old West Regional Commission. Some technical assistance was provided by the South Dakota Division of Conservation. Major fieldwork was performed in the period 1976-79. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

# contents

---

<b>Index to map units</b> .....	iv	Wildlife habitat .....	44
<b>Summary of tables</b> .....	v	Engineering .....	45
<b>Foreword</b> .....	vii	<b>Soil properties</b> .....	51
General nature of the county.....	1	Engineering index properties.....	51
How this survey was made .....	3	Physical and chemical properties .....	51
<b>General soil map units</b> .....	5	Soil and water features.....	53
<b>Detailed soil map units</b> .....	13	<b>Classification of the soils</b> .....	55
Soil descriptions .....	13	Soil series and their morphology .....	55
<b>Use and management of the soils</b> .....	41	<b>Formation of the soils</b> .....	73
Crops and pasture.....	41	<b>References</b> .....	75
Rangeland .....	43	<b>Glossary</b> .....	77
Native woods and windbreaks and environmental plantings.....	44	<b>Tables</b> .....	83

## soil series

Arlo series .....	55	Henkin series .....	63
Beadle series .....	56	Highmore series.....	64
Betts series .....	57	Homme series.....	64
Blendon series.....	57	Hoven series .....	65
Bon series .....	57	Lane series.....	65
Clarno series.....	58	Macken series.....	66
Davis series.....	59	Napa series .....	67
DeGrey series .....	59	Onita series.....	67
Delmont series.....	60	Prosper series.....	68
Dimo series .....	60	Stickney series.....	69
Eakin series.....	61	Talmo series .....	69
Enet series .....	62	Tetonka series .....	70
Ethan series .....	62	Walke series .....	70
Farmsworth series.....	63	Worthing series.....	71

Issued June 1981

# index to map units

---

Ar—Arlo loam .....	13	HbB—Henkin-Blendon fine sandy loams, 2 to 6 percent slopes .....	29
Ax—Arlo loam, wet .....	14	HeA—Highmore-Eakin silt loams, 0 to 2 percent slopes .....	30
BaB—Beadle clay loam, 2 to 6 percent slopes .....	14	HeB—Highmore-Eakin silt loams, 2 to 6 percent slopes .....	30
BeE—Betts-Ethan loams, 15 to 40 percent slopes ....	15	HgA—Highmore-Walke silt loams, 0 to 3 percent slopes .....	32
Br—Bon loam .....	15	HhB—Homme silty clay loam, 2 to 6 percent slopes ..	32
Bo—Bon loam, channeled .....	15	HmB—Homme-Ethan complex, 1 to 6 percent slopes .....	33
CeC—Clarno-Ethan loams, 6 to 9 percent slopes .....	16	HnA—Homme-Onita silty clay loams, 0 to 2 percent slopes .....	34
CnA—Clarno-Ethan-Prosper loams, 0 to 3 percent slopes .....	17	Hv—Hoven silt loam .....	34
CnB—Clarno-Ethan-Prosper loams, 1 to 6 percent slopes .....	18	La—Lane silty clay loam .....	35
CpA—Clarno-Prosper loams, 0 to 2 percent slopes ...	19	Ma—Macken silty clay .....	35
CsA—Clarno-Stickney-Prosper loams, 0 to 3 percent slopes .....	20	Na—Napa silt loam .....	35
DaB—Davis silt loam, 2 to 6 percent slopes .....	20	Oa—Onita silt loam .....	36
DbA—DeGrey-Walke silt loams, 0 to 4 percent slopes .....	21	On—Onita-Tetonka silt loams .....	36
DeA—Delmont loam, 0 to 2 percent slopes .....	22	Pg—Pits, gravel .....	37
DIB—Delmont-Enet loams, 2 to 6 percent slopes .....	22	Pt—Prosper-Tetonka complex .....	37
DmC—Delmont-Talmo loams, 2 to 9 percent slopes ..	23	TaC—Talmo gravelly sandy loam, 2 to 9 percent slopes .....	38
Do—Dimo loam .....	23	Te—Tetonka silt loam .....	38
EaA—Eakin-Ethan complex, 0 to 3 percent slopes ....	24	Wo—Worthing silty clay loam .....	38
EaB—Eakin-Ethan complex, 3 to 6 percent slopes ....	24	Wp—Worthing silty clay loam, ponded .....	39
EaC—Eakin-Ethan complex, 6 to 9 percent slopes ....	26		
EdA—Enet-Delmont loams, 0 to 2 percent slopes .....	27		
EtD—Ethan-Clarno loams, 9 to 15 percent slopes .....	27		
Fa—Farmsworth silt loam .....	28		
HbA—Henkin-Blendon fine sandy loams, 0 to 2 percent slopes .....	29		

# summary of tables

---

Temperature and precipitation (table 1).....	84
Freeze dates in spring and fall (table 2).....	85
<i>Probability. Temperature.</i>	
Growing season (table 3).....	85
<i>Probability. Daily minimum temperature.</i>	
Acres and proportionate extent of the soils (table 4) .....	86
<i>Acres. Percent.</i>	
Yields per acre of crops and pasture (table 5) .....	87
<i>Corn. Oats. Grain sorghum. Alfalfa hay. Bromegrass-alfalfa.</i>	
Rangeland productivity and characteristic plant communities (table 6).....	89
<i>Range site name. Total production. Characteristic vegetation. Composition.</i>	
Windbreaks and environmental plantings (table 7).....	96
Wildlife habitat potentials (table 8).....	103
<i>Potential for habitat elements. Potential as habitat for—Openland wildlife, Wetland wildlife, Rangeland wildlife.</i>	
Building site development (table 9) .....	106
<i>Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets.</i>	
Sanitary facilities (table 10).....	111
<i>Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.</i>	
Construction materials (table 11) .....	116
<i>Roadfill. Sand. Gravel. Topsoil.</i>	
Water management (table 12).....	120
<i>Limitations for—Pond reservoir areas; Embankments, dikes, and levees. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.</i>	
Engineering index properties (table 13) .....	124
<i>Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.</i>	
Physical and chemical properties of the soils (table 14) .....	130
<i>Depth. Permeability. Available water capacity. Soil reaction. Salinity. Shrink-swell potential. Erosion factors. Wind erodibility group. Organic matter.</i>	

---

Soil and water features (table 15).....	134
<i>Hydrologic group. Flooding. High water table. Potential frost action. Risk of corrosion.</i>	
Classification of the soils (table 16).....	137
<i>Soil name. Family or higher taxonomic class.</i>	

# foreword

---

This soil survey contains information that can be used in land-planning programs in Douglas County, South Dakota. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



R. D. Swenson  
State Conservationist  
Soil Conservation Service



# soil survey of Douglas County, South Dakota

---

By Elmer M. Ward, Soil Conservation Service

Soils surveyed by Elmer M. Ward, Warren F. Johnson,  
and David M. Rocklitz, Soil Conservation Service, and  
Dale E. Johnson, South Dakota Division of Conservation

United States Department of Agriculture, Soil Conservation Service,  
in cooperation with the South Dakota Agricultural Experiment Station

DOUGLAS COUNTY is in the southeastern part of South Dakota (fig. 1). It has a total area of 278,272 acres, or about 434.8 square miles. According to the 1970 census, it has a population of 4,569. Armour, the county seat, has a population of 925; Corsica, in the central part of the county, has one of 615; and Delmont, in the southeastern part, one of 260. Other villages in the county are Harrison, Joubert, and New Holland. Only

a few buildings and foundations mark the former villages of Brownsdale, Grandview, Hillside, Houston, and Valley.

This soil survey updates the survey of Douglas County published in 1927 (7). It provides additional information and larger maps, which show the soils in greater detail.

## general nature of the county

This section gives general information concerning the county. It describes climate; physiography, relief, and drainage; settlement; farming; and natural resources.

### climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Douglas county is usually warm in summer, but hot spells are frequent and cool days occasional. The county is very cold in winter, when arctic air frequently surges over the area. Most of the precipitation falls during the warm period, and rainfall is normally heaviest late in spring and early in summer. Winter snowfall is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Armour, South Dakota, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last

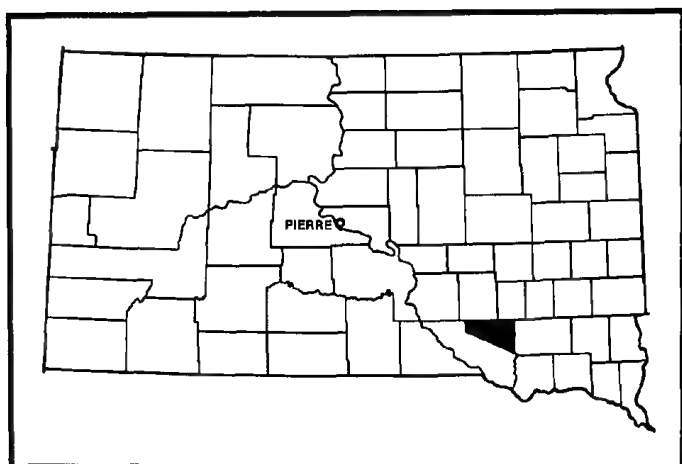


Figure 1.—Location of Douglas County in South Dakota.

freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 22 degrees F, and the average daily minimum temperature is 10 degrees. The lowest temperature on record, which occurred at Armour on January 19, 1970, is -32 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Armour on July 13, 1954, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 22.68 inches. Of this, 17 inches, or 75 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 14 inches. The heaviest 1-day rainfall during the period of record was 4.61 inches at Armour on August 18, 1961. Thunderstorms occur on about 44 days each year, and most occur in summer. Tornadoes and severe thunderstorms strike occasionally. These storms are local in extent and of short duration and result in severe damage in narrow belts. Hailstorms occur occasionally in scattered small areas during the warmer part of the year.

Average seasonal snowfall is 36 inches. The greatest snow depth at any one time during the period of record was 21 inches. On an average of 18 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

## physiography, relief, and drainage

Most of Douglas County is within the Coteau du Missouri division of the Missouri Plateau (4). The northeast part, however, is in the James River Basin, a division of the Central Lowland. The Coteau du Missouri consists of gently rolling and hilly end moraines of the Mankato Substage of Wisconsin Glaciation and nearly level to undulating ground moraines. Much of the material deposited on the ground moraines is silty drift. The James River Basin is a nearly level and gently undulating glacial till plain.

Andes and Choteau Creeks are the major drainageways in the county. They flow south through the

central part of the county. All of the drainageways are intermittent; they carry water only in spring and after heavy rains. In the early 1900's, a drainage ditch was dug from the northwestern part of the county to a point about 3 miles northeast of Corsica. This ditch has silted in and become obstructed with trees and debris throughout the years. As a result, it no longer functions efficiently as a drainageway.

Elevation ranges from about 1,415 feet above sea level at a point along Choteau Creek in the south-central part of the county to about 1,800 feet in the southeastern part.

## settlement

Douglas County was established in 1882 from parts of Yankton, Charles Mix, and Aurora Counties (5). The southern boundary follows the old Yankton Sioux Indian Reservation line. The first areas to be settled were in the northeastern part of the county. The rest of the county was settled when the railroad was completed from Yankton to Mitchell. Railroad transportation was extended into the county in 1886, but service was discontinued early in the 1970's.

By 1890, the county had a population of 4,600. The population reached 7,236 in 1930. It declined to 5,113 by 1960 and 4,569 by 1970.

Roads are on almost every section line. Many have an asphalt or gravel surface. Most rural areas are served by all-weather roads to centers of trade. Commercial airline service is available at Mitchell in adjacent Davison County. South Dakota Highway 44 traverses the county from east to west and Highway 281 from north to south. U.S. Highway 18 crosses the southeastern part of the county.

## farming

Farming is the principal enterprise in Douglas County. About 80 percent of the farm income is derived from the sale of livestock and livestock products. Many of the crops are used as feed for livestock. In 1974, farmland totaled 271,450 acres, which is about 94 percent of the total acreage of the county. The 610 farms averaged 445 acres in size (6). The average size has been increasing since the mid 1930's.

About 70 percent of the farmland is used for cultivated crops or for tame pasture and hay, and about 30 percent is range. Dryland farming is dominant, but a few areas are irrigated. The main cropping system is row crops and small grain grown in rotation with legumes.

Corn and oats are the main cultivated crops. Sorghum, wheat, and barley are also grown. The acreage planted to sorghum and soybeans is increasing. Alfalfa and smooth brome grass are the main crops grown for tame pasture and hay. They were grown on about 16,500 acres in 1975 (3). According to the South Dakota Crop and Livestock Reporting Service, corn was grown on

58,500 acres in 1977, oats on 49,300 acres, sorghum on 14,500 acres, barley on 9,600 acres, and wheat on 5,000 acres. The corn from 47,400 acres was harvested for grain. The rest was used as silage.

## **natural resources**

Soil is the most important resource in the county. It provides a growing medium for cultivated crops and for the grass grazed by livestock. Other natural resources are ground water, wildlife, and sand and gravel.

The principal source of water for domestic use and for livestock is shallow wells. Dugouts in areas of Arlo, Hoven, Macken, Tetonka, and Worthing soils provide additional water for livestock and wildlife.

Cottontail, red fox, whitetail deer, and upland game birds, such as ring-necked pheasant and gray partridge, are the chief wildlife resources. The wetlands provide waterfowl production areas.

Significant deposits of sand and gravel are in the Delmont-Enet-Talmo association, which is described under the heading "General soil map units." Most of the sand and gravel has an excessive amount of fine rock fragments, such as shale, chalk, and clay ironstone, which make it unsuitable as concrete aggregate or as construction material. Deposits of fine sand in the southeastern part of the county, however, are suitable for the production of cement. All of the sand and gravel can be used as subgrade material for roads and as bituminous aggregate.

## **how this survey was made**

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the

kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied to a depth of 5 feet and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.



## general soil map units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 11 associations in this county have been grouped for broad interpretive purposes. The associations and the groups are described on the pages that follow. The names of some of the associations do not agree with those on the general soil maps in the published soil surveys of adjacent Aurora, Davison, and Hutchinson Counties. The names do not fully agree because of differences in the detail of the general soil maps and because of changes in the application of the soil classification system.

### **nearly level to gently rolling, silty and loamy soils on uplands and in upland swales**

These soils dominantly are nearly level and undulating but are gently rolling along some drainageways. They make up about 60 percent of the county. About 67 percent of the acreage is cropland. Corn, oats, alfalfa, and grain sorghum are the main crops. Some areas are irrigated.

#### **1. Eakin-Highmore-Ethan association**

*Well drained, nearly level to gently rolling, silty and loamy soils on uplands*

This association is on uplands that are characterized by gentle rises, swales, and depressions. Slopes generally are nearly level and undulating but are steeper along drainageways. In most areas the drainageways

terminate in small depressions. The drainage pattern is poorly defined in these areas, but it is well defined along the larger drainageways.

This association makes up about 38 percent of the county. It is about 40 percent Eakin soils, 25 percent Highmore soils, 20 percent Ethan soils, and 15 percent minor soils (fig. 2).

The Eakin soils are in convex and smooth areas. Slopes range from 0 to 9 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is brown and pale brown silty clay loam. The underlying material is pale olive and light gray, calcareous clay loam and loam.

The Highmore soils are in smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark grayish brown and light yellowish brown silty clay loam. The underlying material is pale yellow, calcareous silt loam and loam.

The Ethan soils are in convex and smooth areas. In this association they have a slope of 2 to 9 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is dark grayish brown and very pale brown, calcareous loam. The underlying material is pale olive and light yellowish brown, mottled, calcareous clay loam.

Minor in this association are the calcareous Betts soils on knolls and ridges; the well drained, loamy Clarno soils in positions on the landscape similar to those of the Ethan soils; the moderately well drained DeGrey and well drained Walke soils in slightly concave areas and on foot slopes; the poorly drained Hoven and Tetonka and very poorly drained Worthing soils in depressions; and the moderately well drained Onita soils in swales.

About 77 percent of this association is cropland. Corn, small grain, grain sorghum, and alfalfa are the main crops. Some areas are irrigated. Some areas support native grass and are used for grazing or hay. Controlling erosion and conserving moisture are the main concerns in managing cultivated areas.

The major soils are well suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat. They are only fairly well suited to most kinds of building site development because of a moderate shrink-swell potential. They are poorly suited to septic tank absorption fields because of restricted permeability. The possibility of seepage limits the Highmore and Ethan soils as sites for other sanitary facilities.

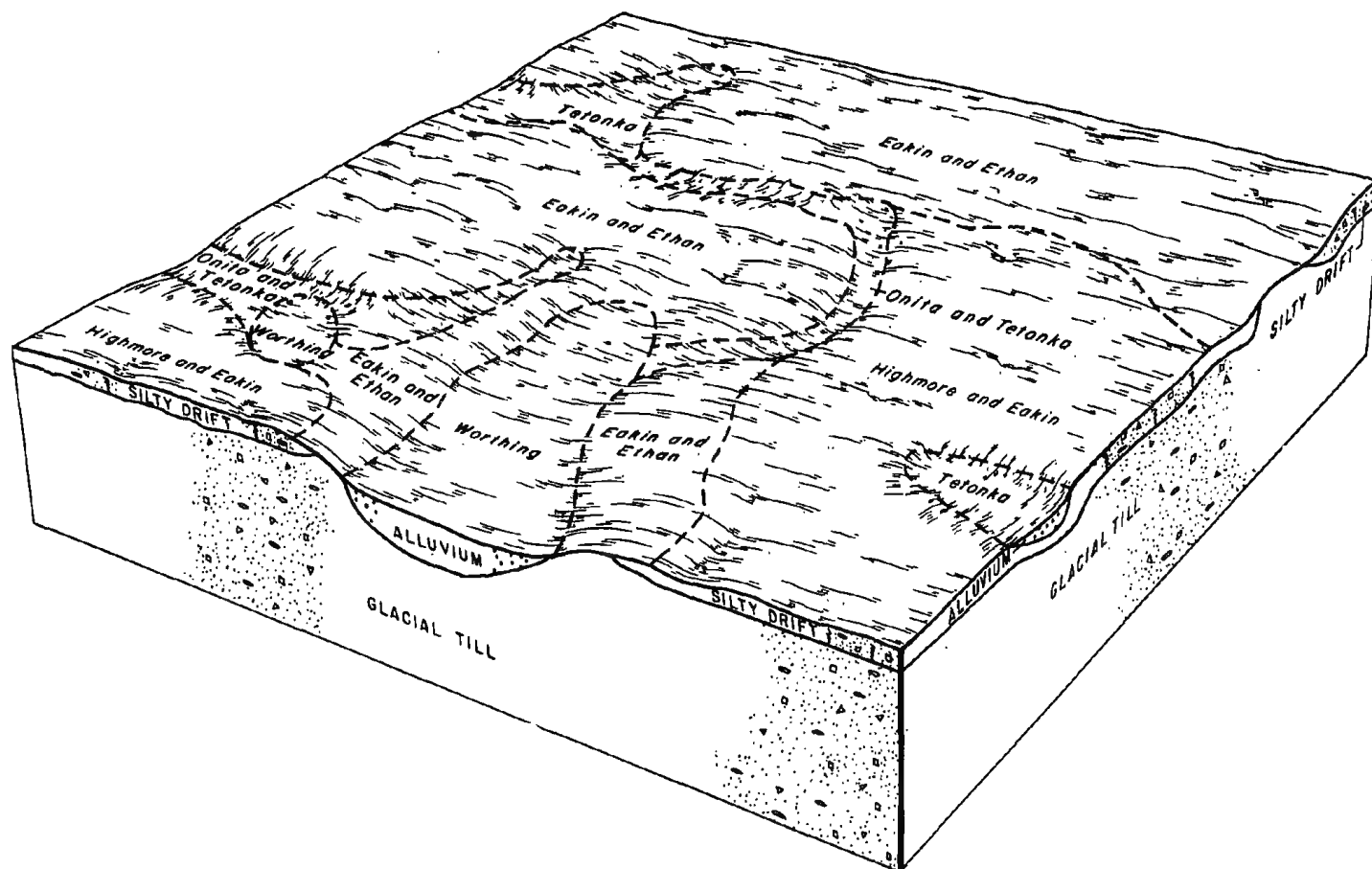


Figure 2.—Pattern of soils and underlying material in the Eakin-Highmore-Ethan association.

## 2. Homme-Onita-Ethan association

*Well drained and moderately well drained, nearly level to gently rolling, silty and loamy soils on uplands and in upland swales*

This association is on uplands characterized by many shallow swales. Slopes generally are nearly level but are steeper along drainageways. The drainage pattern is well defined in most areas.

This association makes up about 4 percent of the county. It is about 55 percent Homme soils, 20 percent Onita soils, 15 percent Ethan soils, and 10 percent minor soils.

The well drained Homme soils are on side slopes, rises, and broad flats. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is brown and pale brown silty clay loam. The underlying material is very pale brown, calcareous silty clay loam over pale yellow, calcareous clay loam.

The moderately well drained Onita soils are on broad flats and in slightly concave swales. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark grayish brown silt loam. The subsoil is dark grayish brown silty clay over grayish brown, calcareous silty clay loam. The underlying material is light olive brown, calcareous silty clay loam over light yellowish brown, calcareous clay loam.

The well drained Ethan soils are in convex areas. In this association they have a slope of 2 to 9 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is dark grayish brown and very pale brown, calcareous loam. The underlying material is pale olive and light yellowish brown, mottled, calcareous clay loam.

Minor in this association are the well drained, loamy Clarno soils and the moderately well drained DeGrey and well drained Walke soils, which occur as areas intermingled with some areas of the Homme soils.

About 87 percent of this association is cropland. Corn, small grain, alfalfa, and grain sorghum are the main

crops. The steeper areas along the larger drainageways support native grass and are used for grazing or hay. Conserving moisture and maintaining fertility in all areas and controlling erosion in the more sloping areas are the main concerns in managing the major soils for crops.

This association is well suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat. The Homme and Ethan soils are only fairly well suited to most kinds of building site development because of a moderate or high shrink-swell potential. They are fairly well suited to most sanitary facilities. The Onita soils generally are unsuitable as sites

for buildings and septic tank absorption fields because they are subject to flooding.

### 3. Highmore-Walke association

*Well drained, nearly level to undulating, silty soils on uplands*

This association is on uplands that are characterized by gentle rises, slight swales, and depressions. The drainage pattern is poorly defined.

This association makes up about 18 percent of the county. It is about 50 percent Highmore soils, 25 percent Walke soils, and 25 percent minor soils (fig. 3).

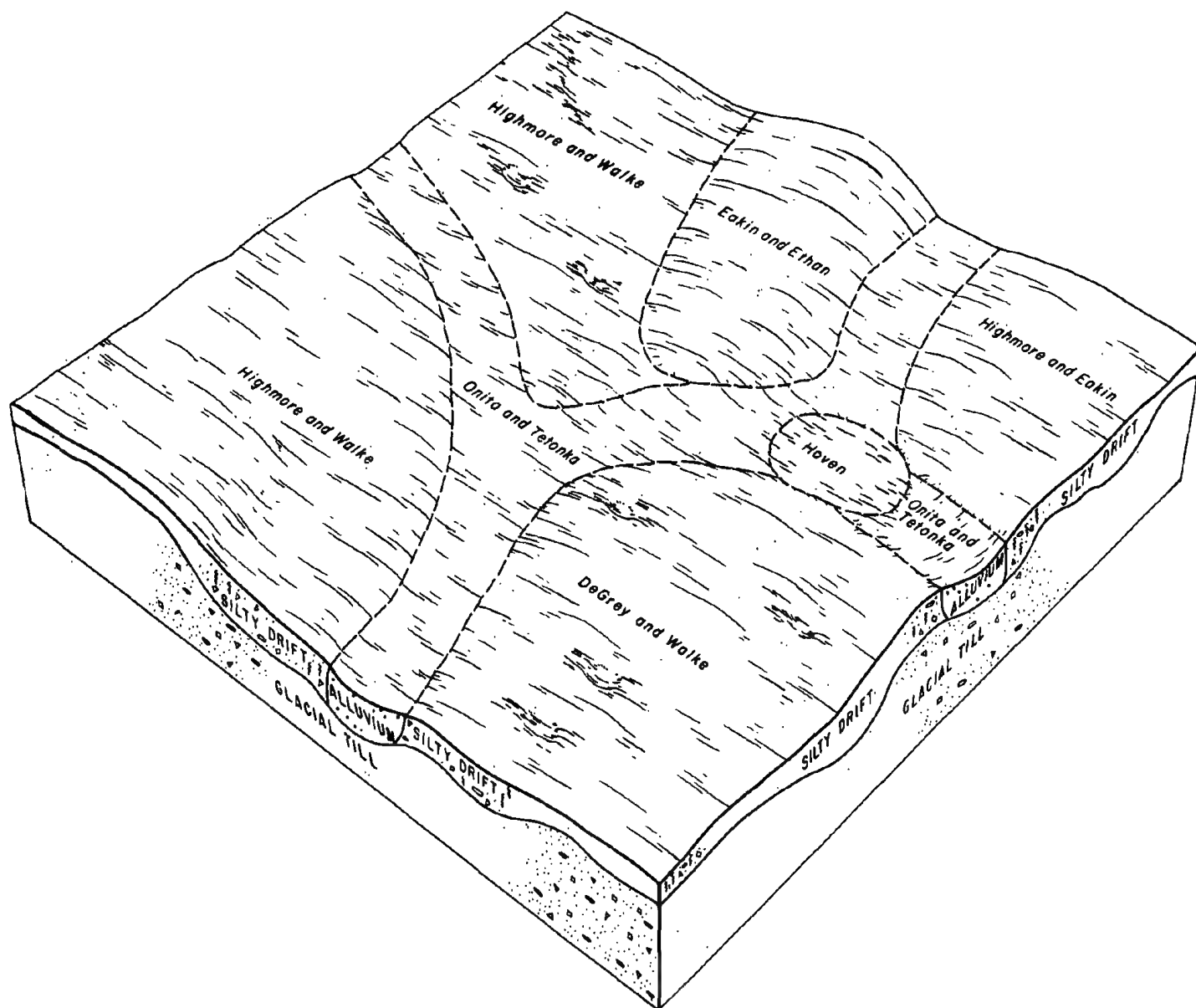


Figure 3.—Pattern of soils and underlying material in the Highmore-Walke association.

The Highmore soils are in the higher smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark grayish brown and light yellowish brown silty clay loam. The underlying material is pale yellow, calcareous silt loam and loam.

The Walke soils are in plane or slightly concave areas. Slopes range from 0 to 4 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is dark grayish brown and grayish brown silty clay. The underlying material is light yellowish brown, calcareous clay loam.

Minor in this association are the moderately well drained, sodium affected DeGrey soils in slightly concave areas; the silty Eakin soils, which are underlain by loamy glacial till and are in positions on the landscape similar to those of the Highmore soils; the well drained, loamy Ethan soils on knolls and ridges; the poorly drained Hoven, Macken, and Tetonka and very poorly drained Worthing soils in depressions; and the moderately well drained Onita soils in swales.

About 63 percent of this association is cropland. Corn, small grain, grain sorghum, and alfalfa are the main crops. Conserving moisture, improving tilth, and increasing the water intake rate are the main concerns of management if the major soils are cropped.

This association is only fairly well suited to cultivated crops and to openland wildlife habitat. It is well suited to tame pasture and hay, range, and rangeland wildlife habitat. The Highmore soils are only fairly well suited to most kinds of building site development because of a moderate shrink-swell potential. The Walke soils are poorly suited because of a high shrink-swell potential. Both soils are poorly suited to septic tank absorption fields because of restricted permeability.

#### **nearly level to rolling, loamy soils on uplands and in upland swales**

These soils dominantly are nearly level and undulating but are gently rolling in some areas and are rolling along some drainageways. They make up about 33 percent of the county. About 65 percent of the acreage is cropland. Corn, oats, alfalfa, and grain sorghum are the main crops. Some areas are irrigated.

#### **4. Clarno-Ethan-Prosper association**

*Well drained and moderately well drained, nearly level to rolling, loamy soils on uplands and in upland swales*

This association is on a glacial till plain characterized by gentle rises, swales, many small depressions, and a few sloughs. The drainage pattern is well defined along the larger drainageways, but it is poorly defined in areas where small drainageways terminate in small sloughs and depressions.

This association makes up about 27 percent of the county. It is about 40 percent Clarno soils, 20 percent

Ethan soils, 20 percent Prosper soils, and 20 percent minor soils (fig. 4).

The well drained Clarno soils are on broad flats and on rises. In this association they have a slope of 0 to 9 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark grayish brown and pale olive loam. The underlying material is pale yellow and pale olive, calcareous loam and clay loam.

The well drained Ethan soils are in convex areas. In this association they have a slope of 2 to 15 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is dark grayish brown and very pale brown, calcareous loam. The underlying material is pale olive and light yellowish brown, mottled, calcareous clay loam.

The moderately well drained Prosper soils are in slight swales and in concave areas on the lower parts of slopes. Slopes generally range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray clay loam and loam. The underlying material is light gray and pale yellow, calcareous loam.

Minor in this association are the moderately well drained Bon soils along small drainageways; the moderately well drained Stickney soils, which have a sodium affected subsoil and are on the lower parts of the landscape; and the poorly drained Tetonka and very poorly drained Worthing soils in depressions.

About 76 percent of this association is cropland. Corn, small grain, grain sorghum, and alfalfa are the main crops. A few areas are irrigated. Some areas support native grass and are used for grazing. Controlling erosion, conserving moisture, and maintaining tilth and fertility are the main concerns of management if the major soils are cropped.

This association is well suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat. The Clarno and Ethan soils are only fairly well suited to most kinds of building site development because of a moderate shrink-swell potential. They are poorly suited to septic tank absorption fields because of restricted permeability. Because of the possibility of seepage, they are limited as sites for sewage lagoons. Prosper soils generally are unsuitable as sites for buildings and most sanitary facilities because of flooding.

#### **5. Clarno-Prosper-Stickney association**

*Well drained and moderately well drained, nearly level, loamy soils on uplands and in upland swales*

This association is on a glacial till plain characterized by many small depressions and a few sloughs. The drainage pattern is poorly defined.

This association makes up about 3 percent of the county. It is about 45 percent Clarno soils, 25 percent Prosper soils, 20 percent Stickney soils, and 10 percent minor soils.

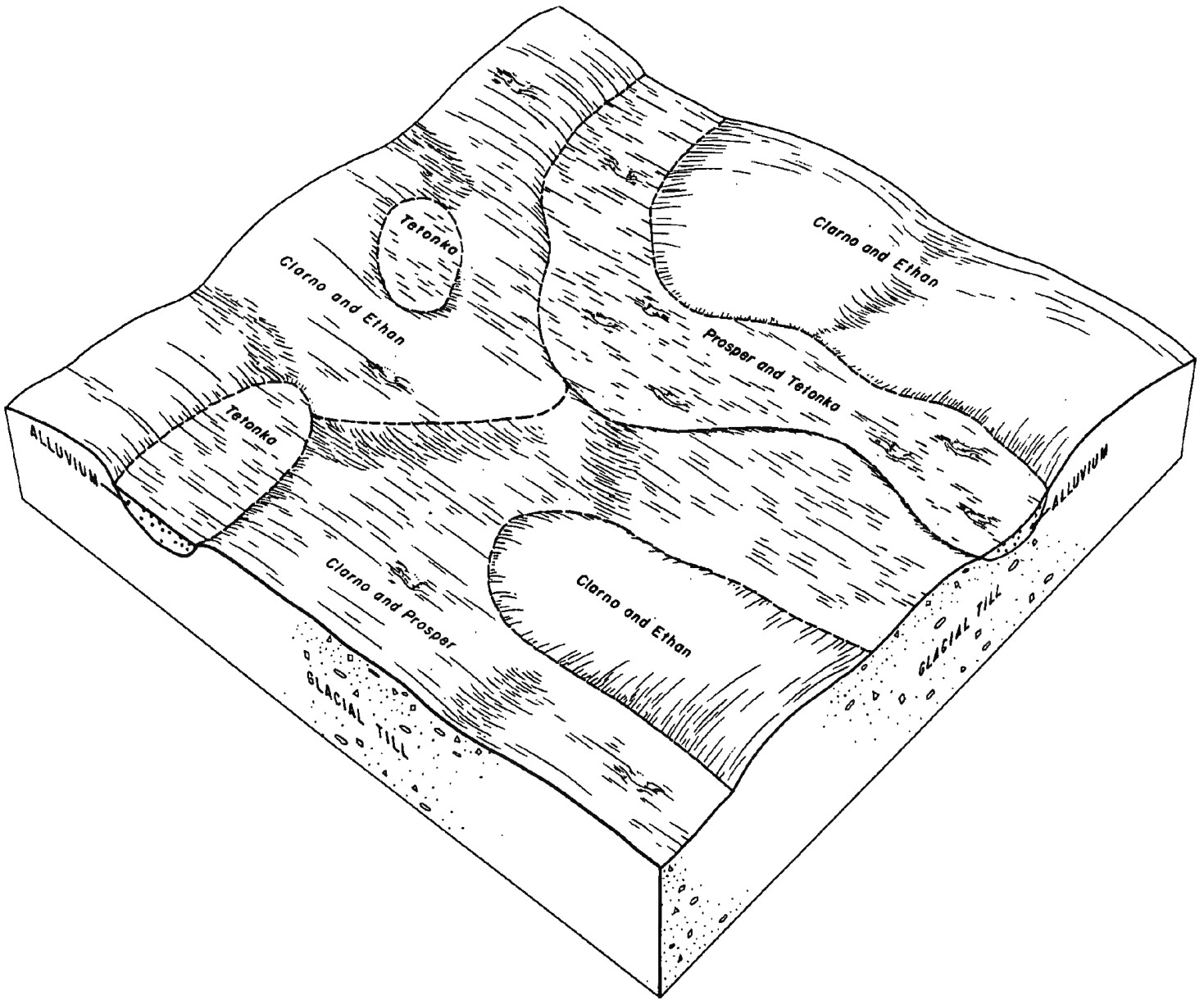


Figure 4.—Pattern of soils and underlying material in the Clarno-Ethan-Prosper association.

The well drained Clarno soils are on rises. In this association they have a slope of 0 to 3 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark grayish brown and pale olive loam. The underlying material is pale yellow and pale olive, calcareous loam and clay loam.

The moderately well drained Prosper soils are in slight swales and in concave areas on the lower parts of slopes. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray

clay loam and loam. The underlying material is light gray and pale yellow, calcareous loam.

The moderately well drained Stickney soils are in concave areas in an intermediate position between the Clarno and Prosper soils. Slopes generally range from 0. to 2 percent. Typically, the surface layer is very dark gray loam. The subsurface layer is gray silt loam. The subsoil is dark grayish brown, very dark brown, very dark gray, grayish brown, and light yellowish brown silty clay loam and clay loam. The underlying material is pale olive and light yellowish brown, mottled, calcareous loam.

Minor in this association are the well drained Ethan soils on rises and the poorly drained Tetonka and very poorly drained Worthing soils in depressions.

About 87 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. Some areas support native grass and are used for grazing. Conserving moisture and maintaining tilth are the main concerns of management if the major soils are cropped.

This association generally is well suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat. The Clarno soils are only fairly well suited to most kinds of building site development because of a moderate shrink-swell potential. The Stickney and Prosper soils are poorly suited because of a high shrink-swell potential. Also, flooding is a hazard on the Prosper soils. All three soils are poorly suited to septic tank absorption fields because of restricted permeability. Also, the Prosper soils are poorly suited because of flooding.

## 6. Clarno-Prosper association

*Well drained and moderately well drained, nearly level, loamy soils on uplands and in upland swales*

This association is on uplands characterized by many swales and depressions. The drainage pattern is poorly defined.

This association makes up about 3 percent of the county. It is about 65 percent Clarno soils, 20 percent Prosper soils, and 15 percent minor soils.

The well drained Clarno soils are in convex or smooth areas. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark grayish brown and pale olive loam. The underlying material is pale yellow and pale olive, calcareous loam and clay loam.

The moderately well drained Prosper soils are in slight swales and in concave areas on the lower parts of slopes. In this association they have a slope of 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray clay loam and loam. The underlying material is light gray and pale yellow, calcareous loam.

Minor in this association are the loamy, calcareous Ethan soils on rises; the moderately well drained Stickney soils, which have a sodium affected subsoil and occur as areas intermingled with some areas of the Clarno soils; and the poorly drained Tetonka soils in depressions.

About 87 percent of this association is cropland. Corn, small grain, alfalfa, and grain sorghum are the main crops. Some areas support native grass and are used for grazing or hay. Conserving moisture and maintaining fertility are the main concerns in managing cultivated areas.

This association is well suited to cultivated crops and to tame pasture and hay, range, and openland and

rangeland wildlife habitat. The Clarno soils are only fairly well suited to most kinds of building site development because of a moderate shrink-swell potential. They are poorly suited to septic tank absorption fields because of restricted permeability. Because of the possibility of seepage, they are limited as sites for sewage lagoons. The Prosper soils generally are unsuitable as sites for buildings and most sanitary facilities because they are subject to flooding.

## nearly level to gently rolling, loamy soils on uplands and terraces

These soils dominantly are nearly level and gently rolling but are undulating in some areas. They make up about 4 percent of the county. About 60 percent of the acreage is cropland. Corn, oats, alfalfa, and grain sorghum are the main crops. Many areas are irrigated.

## 7. Henkin-Blendon association

*Well drained, nearly level to undulating, loamy soils on uplands and terraces*

This association is on a glacial melt water plain characterized by gentle rises, swales, many small depressions, and a few marshy sloughs. The drainage pattern is poorly defined.

This association makes up about 1 percent of the county. It is about 60 percent Henkin soils, 30 percent Blendon soils, and 10 percent minor soils.

The Henkin soils are on rises and in smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark grayish brown fine sandy loam. The subsoil is dark grayish brown, brown, and pale brown fine sandy loam. It is calcareous in the lower part. The underlying material is pale brown, calcareous very fine and fine sand.

The Blendon soils are in swales and in concave areas on the lower foot slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark grayish brown fine sandy loam. The subsoil is dark grayish brown, very friable fine sandy loam. The underlying material is grayish brown and brown loamy fine sand.

Minor in this association are the Delmont and Enet soils, which are underlain by gravelly sand, and the poorly drained Tetonka soils in depressions.

About 87 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. Some areas support native grass and are used for grazing. Controlling soil blowing, conserving moisture, and maintaining fertility are the main concerns of management if the major soils are cropped.

This association is well suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat. It also is well suited to most kinds of building site development. It is poorly suited to most sanitary facilities because the effluent can seep

through the sandy underlying material and pollute shallow ground water.

### 8. Delmont-Enet-Talmo association

*Well drained to excessively drained, nearly level to gently rolling, loamy soils on uplands and terraces*

This association is on a glacial outwash plain characterized by many small depressions and a few sloughs. Slopes generally are gently rolling but are nearly level in some areas. The drainage pattern is well defined along the larger drainageways but is poorly defined where small drainageways terminate in the small sloughs and depressions.

This association makes up about 3 percent of the county. It is about 40 percent Delmont soils, 30 percent Enet soils, 10 percent Talmo soils, and 20 percent minor soils.

The somewhat excessively drained Delmont soils are on rises. Slopes range from 0 to 9 percent. Typically, the surface layer and the subsoil are very dark grayish brown loam. The underlying material is multicolored, calcareous gravelly sand.

The well drained Enet soils are on rises and in smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark gray loam. The subsoil is very dark gray and dark grayish brown loam and sandy loam. The underlying material is multicolored, calcareous gravelly sand.

The excessively drained Talmo soils are in convex areas. Slopes range from 2 to 9 percent. Typically, the surface layer is very dark gray loam. The underlying material is multicolored, calcareous gravelly sand.

Minor in this association are the well drained Clarno and Henkin soils, which are not underlain by gravelly sand, and the very poorly drained Worthing and poorly drained Tetonka soils in depressions.

About 69 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. A few areas are irrigated. Some of the steeper areas and some areas of the poorly drained and very poorly drained minor soils in closed depressions support native grass and are used for grazing. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management if the major soils are cropped.

This association is fairly well suited to range and to rangeland wildlife habitat. The Delmont soils are fairly well suited to tame pasture and hay and poorly suited to cultivated crops. The Enet soils are well suited to tame pasture and hay and fairly well suited to cultivated crops. The Talmo soils are poorly suited to tame pasture and hay and generally are unsuited to cultivated crops. All three soils are well suited to most kinds of building site development. They are poorly suited to most sanitary facilities because the effluent can seep through the

gravelly underlying material and pollute shallow ground water.

### nearly level to steep, loamy soils on uplands and flood plains

These soils are on side slopes and flood plains along large drainageways. They dominantly are steep, but they are nearly level on the flood plains. They make up about 1 percent of the county. About 95 percent of the acreage is range.

### 9. Ethan-Bon-Betts association

*Well drained and moderately well drained, nearly level to steep, loamy soils on uplands and flood plains*

This association is on side slopes along the smaller drainageways and on flood plains along the larger drainageways. Slopes generally are moderately steep to steep on the side slopes. They are nearly level on the flood plains. The drainage pattern is well defined.

This association makes up about 1 percent of the county. It is about 45 percent Ethan soils, 25 percent Bon soils, 20 percent Betts soils, and 10 percent minor soils.

The well drained Ethan soils are in convex and smooth areas. In this association they have a slope of 9 to 40 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The subsoil is dark grayish brown and very pale brown, calcareous loam. The underlying material is pale olive and light yellowish brown, mottled, calcareous clay loam.

The moderately well drained Bon soils are on flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsurface layer is dark grayish brown and dark gray, calcareous loam. The underlying material is grayish brown and pale olive, calcareous loam stratified with thin layers of fine and very fine sand.

The well drained Betts soils are in convex areas. Slopes range from 15 to 40 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown, calcareous clay loam. The underlying material is light yellowish brown, calcareous loam and clay loam.

Minor in this association are the somewhat excessively drained Delmont soils, which are underlain by gravelly sand, and the moderately well drained Prosper soils in swales where water drains into the main drainageways.

About 90 percent of this association is range. Controlling erosion and runoff is the main concern of management.

This association is fairly well suited to range, tame pasture and hay, and rangeland wildlife habitat. It generally is unsuited to cultivated crops, building site development, and sanitary facilities because of the slope of the Ethan and Betts soils and flooding on the Bon soils.

## **nearly level, loamy and silty soils on flood plains, terraces, and foot slopes**

These soils make up about 2 percent of the county. About 49 percent of the acreage is cropland. Corn, oats, alfalfa, and grain sorghum are the main crops. Some areas are irrigated.

### **10. Bon-Farmsworth-Napa association**

*Moderately well drained to poorly drained, nearly level, loamy and silty soils on flood plains*

This association is on flood plains dissected by a meandering stream channel several feet deep and several feet wide. The drainage pattern is poorly defined in all areas except for those near the channel.

This association makes up about 1 percent of the county. It is about 45 percent Bon soils, 30 percent Farmsworth soils, and 25 percent Napa soils.

The moderately well drained Bon soils are near the stream channel. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsurface layer is dark grayish brown and dark gray, calcareous loam. The underlying material is grayish brown and pale olive, calcareous loam stratified with thin layers of fine and very fine sand.

The somewhat poorly drained Farmsworth soils are in slightly concave areas. Slopes are 0 to 1 percent. Typically, the surface layer is dark gray silt loam. The subsurface layer is light gray silt loam. The subsoil is dark gray and grayish brown silty clay. The underlying material is light brownish gray, calcareous clay loam.

The poorly drained Napa soils are in slightly concave areas. Slopes are less than 2 percent. Typically, the surface layer is gray silt loam. The subsoil is dark gray silty clay. The underlying material is gray, light gray, and light olive gray, mottled, calcareous silty clay and silty clay loam.

About 77 percent of this association is cropland. Corn, small grain, grain sorghum, and alfalfa are the main crops. Some areas support native grass and are used for grazing or hay. Maintaining tilth and fertility is the main concern of management if the soils are cropped.

This association is poorly suited to cultivated crops and to tame pasture and hay and openland wildlife habitat. It is well suited to range and rangeland wildlife habitat. It generally is unsuited to building site

development and sanitary facilities because of the flooding.

### **11. Lane-Bon association**

*Well drained and moderately well drained, nearly level, silty and loamy soils on stream terraces, foot slopes, and flood plains*

This association is along drainageways characterized by meandering channels. Slopes grade gently to the drainage channel.

This association makes up about 1 percent of the county. It is about 60 percent Lane soils, 35 percent Bon soils, and 5 percent minor soils.

The well drained Lane soils are on foot slopes and on broad flats on the parts of stream terraces away from the drainage channel. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray silty clay loam. The subsoil is very dark gray and grayish brown silty clay. The underlying material is grayish brown and light brownish gray, calcareous silty clay loam.

The moderately well drained Bon soils are on the flats in old channels and in areas adjacent to the present channel. Slopes are less than 2 percent. Typically, the surface layer is dark gray loam. The subsurface layer is dark grayish brown and dark gray, calcareous loam. The underlying material is grayish brown and pale olive, calcareous loam stratified with thin layers of fine and very fine sand.

Minor in this association are the well drained Homme soils. These soils occur as areas intermingled with some areas of the Lane soils.

About 92 percent of this association is cropland. Corn, small grain, grain sorghum, and alfalfa are the main crops. A few areas are irrigated. The areas bordering the larger drainageways support native grass and are used for grazing or hay. Maintaining tilth and fertility and conserving moisture are the main concerns of management if the major soils are cropped.

This association is well suited to cultivated crops and to tame pasture and hay, range, and openland and rangeland wildlife habitat. The Lane soils are poorly suited to building site development because of a high shrink-swell potential. They are poorly suited to septic tank absorption fields because of restricted permeability. The Bon soils generally are unsuitable as sites for buildings and sanitary facilities because of the flooding.

## detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and identifies the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Delmont loam, 0 to 2 percent slopes, is one of several phases in the Delmont series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Eakin-Ethan complex, 3 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

The names of some of the map units identified on the detailed soil maps do not fully agree with those identified on the maps in the soil surveys of adjacent Aurora, Davison, and Hutchinson Counties. Differences are the result of variations in the design and composition of map units or changes in the application of the soil classification system.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

### soil descriptions

**Ar—Arlo loam.** This poorly drained, nearly level soil is on low outwash plains and in swales on uplands. It is occasionally flooded. It is moderately deep over gravelly sand. Areas are 5 to several hundred acres in size and are irregular in shape. Slopes are short and are smooth or concave.

Typically, the surface layer is dark gray, calcareous loam about 8 inches thick. The subsurface layer is gray, very friable, calcareous loam about 15 inches thick. The subsoil is gray, very friable, calcareous loam about 13 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the gravelly sand is 10 to 20 inches from the surface.

Included with this soil in mapping are small areas of Enet and Tetonka soils. These soils make up less than 15 percent of any one mapped area. The well drained Enet soils are on the higher parts of the landscape near the edge of the mapped areas. The poorly drained Tetonka soils are in depressions and entrenched swales. Their subsoil contains more clay than that of the Arlo soil.

The content of organic matter is moderate and fertility medium in the Arlo soil. Permeability is moderate in the subsoil and rapid in the underlying material. Available

water capacity is moderate. A seasonal high water table is within a depth of 2 feet in most years. Runoff is slow.

Most areas support native grass. This soil is well suited to range. The natural plant cover dominantly is big bluestem, switchgrass, indiagrass, prairie cordgrass, and, to a lesser extent, sedges and forbs. Overused areas are dominated by western wheatgrass, inland saltgrass, and Kentucky bluegrass. Many areas are potential sites for excavated ponds.

This soil is fairly well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, smooth brome grass, and switchgrass. The availability of plant nutrients is adversely affected by the high content of lime. Planting and harvesting are delayed in some years because of wetness and flooding. Late maturing crops are better suited than early maturing crops. Leaving crop residue on the surface improves tilth and fertility.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs can grow well, especially those that grow well in areas where the supply of moisture is high.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the flooding and the wetness. It is a probable source of sand and gravel for use as road construction material.

The capability subclass is IIIw; Subirrigated range site.

**Ax—Arlo loam, wet.** This deep, very poorly drained, nearly level soil is in entrenched swales and depressions in the uplands. It is frequently flooded, and water stands on the surface for brief periods. Areas are 4 to 90 acres in size and generally are long and narrow. Slopes are concave.

Typically, the surface layer is very dark gray, calcareous loam about 8 inches thick. The subsurface layer is dark gray, friable, calcareous clay loam about 15 inches thick. The subsoil is dark gray and gray, firm, calcareous clay loam about 13 inches thick. The upper part of the underlying material, to a depth of 49 inches, is gray, firm, calcareous clay loam. The lower part to a depth of 60 inches is multicolored gravelly sand. In places the surface layer is noncalcareous.

Included with this soil in mapping are small areas of the very poorly drained Worthing soils in depressions. These soils make up less than 10 percent of any one mapped area. They are noncalcareous to a depth of at least 35 inches.

The content of organic matter is moderate and fertility medium in the Arlo soil. Permeability is moderate in the subsoil and rapid in the underlying gravelly sand. Available water capacity is moderate. A seasonal high water table is within a depth of 2 feet. As much as 0.5 foot of water ponds on the surface during wet periods. Runoff is very slow or ponded.

Nearly all areas support native grass. This soil is fairly well suited to range. The native vegetation dominantly is

prairie cordgrass, big bluestem, and, to a lesser extent, wetland sedges. Overused areas are dominated by sedges, rushes, foxtail barley, Kentucky bluegrass, and saltgrass. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and windbreaks and environmental plantings because of wetness. It is suited to tame pasture and hay. Garrison creeping foxtail and reed canarygrass are suitable.

This soil generally is unsuited to building site development and sanitary facilities because of the flooding and the wetness. It is a probable source of sand and gravel for use as road construction material.

The capability subclass is Vw; Wetland range site.

**BaB—Beadle clay loam, 2 to 6 percent slopes.** This deep, well drained, gently sloping soil is on uplands. Areas are 5 to 60 acres in size and are irregular in shape. Most of the slopes are long and smooth, but some are short and complex.

Typically, the surface layer is very dark gray and dark gray clay loam about 7 inches thick. The subsoil is dark gray, very dark grayish brown, and grayish brown clay loam about 23 inches thick. It is firm in the upper part and is friable and calcareous in the lower part. The underlying material to a depth of 60 inches is pale olive and olive, calcareous clay loam. In places the surface layer is calcareous.

Included with this soil in mapping are small areas of Lane soils in swales and on foot slopes. These soils make up less than 15 percent of any one mapped area. They are dark to a depth of more than 20 inches.

The content of organic matter is moderate and fertility medium in the Beadle soil. Tilth is poor. Permeability is slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high in the subsoil.

Most of the acreage is cropland. This soil is fairly well suited to cultivated crops. It is well suited to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. Controlling erosion, improving tilth, and conserving moisture are the main concerns in managing cultivated areas. Tilling when the soil is wet causes compaction of the subsoil. Minimizing tillage and leaving crop residue on the surface help to control erosion, conserve moisture, and improve tilth. Contour farming, grassed waterways, and terraces also help to control erosion, but some slopes are too short or irregular for contouring and terracing.

This soil is fairly well suited to windbreaks and environmental plantings. Most of the climatically suited trees and shrubs grow well.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass and green needlegrass. Overused areas are dominated by western wheatgrass. After continued overuse, blue grama and less palatable sedges and weeds dominate the site.

Because of the high shrink-swell potential, this soil is poorly suited to most kinds of building site development.

Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the restricted permeability, this soil is poorly suited to septic tank absorption fields. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The capability subclass is IIIe; Clayey range site.

**BeE—Betts-Ethan loams, 15 to 40 percent slopes.**

These deep, well drained, hilly and steep soils are on uplands that in some areas are dissected by well defined drainageways. The Betts soil is on the upper parts of the convex slopes and on ridgetops. The Ethan soil is on the convex mid and lower side slopes. Areas are 5 to 95 acres in size and are irregular in shape. They are 45 to 55 percent Betts soil and 35 to 45 percent Ethan soil.

The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Betts soil is dark grayish brown loam about 3 inches thick. The subsoil is brown, friable, calcareous clay loam about 6 inches thick. The underlying material to a depth of 60 inches is light yellowish brown, calcareous loam and clay loam. In places it has thin strata of silt loam or very fine sand.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer and the upper part of the subsoil do not have free carbonates.

Included with these soils in mapping are small areas of Davis, Delmont, and Prosper soils. These included soils make up less than 20 percent of any one mapped area. Davis and Prosper soils are dark to a depth of more than 20 inches. They are lower on the landscape than the Betts and Ethan soils. Delmont soils have gravelly sand below a depth of 20 inches. Their position on the landscape is similar to that of the Betts and Ethan soils.

The content of organic matter and fertility are low in the Betts and Ethan soils. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. Runoff is rapid. The shrink-swell potential is moderate.

Most areas support native grass. These soils are fairly well suited to range. The native vegetation dominantly is little bluestem, needlegrasses, western wheatgrass, and sideoats grama. Overused areas are dominated by needleandthread, western wheatgrass, sideoats grama, blue grama, and annual grasses and weeds.

These soils generally are too steep for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, building site development, and

most sanitary facilities. Climatically suited trees and shrubs can be established for special purposes if they are planted by hand and given special care.

The Betts soil is in capability subclass VIIe, Thin Upland range site; the Ethan soil is in capability subclass VIe, Silty range site.

**Bn—Bon loam.** This deep, well drained, nearly level soil is on stream terraces and flood plains. It is occasionally flooded. Areas are 10 to 100 acres in size and are long and narrow.

Typically, the surface layer is dark gray loam about 5 inches thick. The subsurface layer is very friable loam about 17 inches thick. It is dark grayish brown in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches is grayish brown and pale olive loam stratified with thin layers of fine and very fine sand.

Included with this soil in mapping are small areas of a soil that contains less sand and more silt between depths of 10 and 40 inches. This included soil makes up less than 15 percent of any one mapped area. It is on the slightly lower parts of the flood plain.

The content of organic matter and fertility are high in the Bon soil. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most of the acreage is cropland. This soil is well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth brome grass. Conserving moisture is the main concern in managing cultivated areas. Floodwater delays planting in some years, but in most years the additional moisture is beneficial and the flood damage is minor. Leaving crop residue on the surface and including grasses and legumes in the cropping system increase the content of organic matter and conserve moisture.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

This soil is well suited to range. The native vegetation dominantly is big bluestem and green needlegrass. Overused areas are dominated by western wheatgrass and Kentucky bluegrass. After continued overuse, Kentucky bluegrass and weeds occupy the site.

Because of the flooding, this soil generally is unsuitable as a site for buildings and sanitary facilities.

The capability subclass is IIc; Overflow range site.

**Bo—Bon loam, channeled.** This deep, moderately well drained, nearly level soil is on flood plains that are dissected into many small tracts by narrow channels and partly filled old stream meanders (fig. 5). It is frequently flooded. Areas are 10 to more than 100 acres in size and are long and narrow.

Typically, the surface layer is very dark gray loam about 7 inches thick. The subsurface layer is dark gray and very dark gray, very friable loam about 23 inches thick. The underlying material to a depth of 60 inches is



Figure 5.—A meandering channel in an area of Bon loam, channeled.

gray, stratified loam, clay loam, and fine sandy loam. In places sand and gravel are between depths of 40 and 60 inches.

Included with this soil in mapping are small areas of a soil that contains less sand and more silt between depths of 10 and 40 inches. This included soil makes up less than 15 percent of any one mapped area. It is on the slightly lower parts of the flood plain.

The content of organic matter and fertility are high in the Bon soil. Permeability is moderate. Available water capacity is high. A high water table is at a depth of 2 to 6 feet in the spring of most years. Runoff is slow.

Most areas are used for tame pasture or hay. This soil is well suited to tame pasture and hay, but the fields generally are dissected into small tracts by the meandering streams. Alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth bromegrass are suitable.

This soil is well suited to range. The native vegetation dominantly is big bluestem. Overused areas are dominated by Kentucky bluegrass, foxtail barley, and saltgrass.

Because of the small size of each tract and the flooding in spring, this soil generally is unsuited to cultivated crops.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Because of the meandering stream channels, they generally cannot be planted by machine, but hand planted trees and shrubs can be readily established.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the flooding.

The capability subclass is VIw; Subirrigated range site.

#### **CeC—Clarno-Ethan loams, 6 to 9 percent slopes.**

These deep, well drained, gently rolling soils are on uplands. The Clarno soil is on the longer, smoother side slopes. The Ethan soil is on the upper slopes and on ridgetops. Areas are 5 to 125 acres in size and are irregular in shape. They are 50 to 60 percent Clarno soil and 25 to 35 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 9 inches thick. The subsoil is friable loam about 21 inches thick. The upper part is dark grayish brown, and the lower part is pale olive, is calcareous, and has spots and streaks of lime

that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow and pale olive, calcareous loam and clay loam. It has accumulations of carbonate in the upper part. In places it has strata of silt and very fine sand.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Prosper and Tetonka soils. These included soils make up to 15 to 20 percent of any one mapped area. The moderately well drained Prosper soils are in swales. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate in the Clarno soil and low in the Ethan soil. Fertility is medium in the Clarno soil and low in the Ethan soil. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are fairly well suited to cultivated crops. Controlling erosion and conserving moisture are the main concerns of management. Improving the fertility of the Ethan soil also is a concern. The high content of lime in the surface layer of this soil adversely affects the availability of plant nutrients. Minimizing tillage and leaving crop residue on the surface help to control erosion, conserve moisture, and improve fertility and tilth. Contour farming, grassed waterways, and terraces also help to control erosion, but the slopes in some areas are too short or too irregular for contouring and terracing.

A cover of tame pasture plants or hay is effective in controlling erosion. These soils are well suited to tame pasture and hay, but forage production is limited by the high content of lime in the Ethan soil. Alfalfa, intermediate wheatgrass, and smooth brome grass are the best suited species.

These soils are well suited to range. The native vegetation dominantly is green needlegrass and western wheatgrass. Overused areas are dominated by western wheatgrass, blue grama, and Kentucky bluegrass.

These soils are fairly well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well on the Clarno soil. No trees or shrubs grow well on the Ethan soil; optimum survival and vigor are unlikely. Planting on the contour helps to control erosion.

Because of the slope and the shrink-swell potential, these soils are only fairly well suited to most kinds of building site development. Buildings should be designed to conform to the natural slope of the land. Land shaping

is needed in some areas. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the slope and the restricted permeability, these soils are only fairly well suited to sanitary facilities. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Land shaping and installation of the distribution lines across the slope generally improve the efficiency of the absorption field.

The Clarno soil is in capability subclass IIIe, the Ethan soil in capability subclass IVe; both soils are in Silty range site.

**CnA—Clarno-Ethan-Prosper loams, 0 to 3 percent slopes.** These deep, nearly level soils are on uplands. The well drained Clarno soil is in smooth areas. The well drained Ethan soil is on slight rises. The moderately well drained Prosper soil is in swales. It is occasionally flooded by runoff from the Clarno and Ethan soils. Areas are 20 to more than 100 acres in size and are irregular in shape. They are 40 to 50 percent Clarno soil, 15 to 25 percent Ethan soil, and 15 to 25 percent Prosper soil. The three soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 9 inches thick. The subsoil is friable loam about 21 inches thick. The upper part is dark grayish brown, and the lower part is pale olive, is calcareous, and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow and pale olive, calcareous loam and clay loam. It has accumulations of carbonate in the upper part. In places it has thin strata of silt and very fine sand. In some areas the subsoil contains more clay.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime.

Typically, the surface layer of the Prosper soil is dark gray loam about 12 inches thick. The subsoil is about 23 inches thick. The upper part is dark grayish brown and grayish brown, friable clay loam. The lower part is light brownish gray, friable, calcareous loam having accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light gray and pale yellow, mottled, calcareous loam.

Included with these soils in mapping are small areas of Stickney and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Stickney soils have a sodium affected subsoil. They are

slightly lower on the landscape than the Clarno soil. The Tetonka soils are poorly drained and are in small depressions.

The content of organic matter is moderate and fertility medium in the Clarno soil. Both the content of organic matter and fertility are low in the Ethan soil and high in the Prosper soil. Permeability is moderate in the subsoil of all three soils and moderately slow in the underlying material. Available water capacity is high. The Prosper soil has a seasonal water table at a depth of 3 to 6 feet. Runoff is slow on all of the soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, smooth brome grass, crested wheatgrass, and pubescent wheatgrass. Conserving moisture is the main concern in managing cultivated areas. Improving the fertility of the Ethan soil also is a concern. Planting and harvesting are delayed in areas of the Prosper soil during some wet periods. Leaving crop residue on the surface and including grasses and legumes in the cropping system conserve moisture, increase the content of organic matter, and improve fertility.

These soils are well suited to range. The native vegetation dominantly is green needlegrass and western wheatgrass on the Clarno and Ethan soils and big bluestem on the Prosper soil. Overused areas are dominated by blue grama and Kentucky bluegrass.

The Clarno and Prosper soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that grow well in areas where the supply of moisture is high are especially well suited to the Prosper soil. No trees and shrubs grow well on the Ethan soil.

Because the Prosper soil is subject to flooding, the Clarno and Ethan soils are better suited to building site development. Their shrink-swell potential, however, is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Clarno and Ethan soils are well suited and the Prosper soil poorly suited to most sanitary facilities. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste in the Clarno and Ethan soils.

The Clarno soil is in capability subclass IIc, Silty range site; the Ethan soil is in capability subclass IIIe, Silty range site; the Prosper soil is in capability subclass IIc, Overflow range site.

**CnB—Clarno-Ethan-Prosper loams, 1 to 6 percent slopes.** These deep, nearly level and undulating soils are in areas on uplands where slopes generally are short and convex. The well drained Clarno soil is on side slopes. The well drained Ethan soil is on the upper

convex slopes and on ridgetops. The moderately well drained Prosper soil is in swales and low toe slopes. It is occasionally flooded by runoff from the Clarno and Ethan soils. Areas are 5 to more than 100 acres in size and are irregular in shape. They are 35 to 45 percent Clarno soil, 25 to 35 percent Ethan soil, and 15 to 25 percent Prosper soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 9 inches thick. The subsoil is friable loam about 21 inches thick. The upper part is dark grayish brown, and the lower part is pale olive, is calcareous, and has spots and streaks of soft lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow and pale olive, calcareous loam and clay loam. It has accumulations of carbonate in the upper part. In places it is stratified silt and very fine sand.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Prosper soil is dark gray loam about 12 inches thick. The subsoil is about 23 inches thick. The upper part is dark grayish brown and grayish brown, friable clay loam. The lower part is light brownish gray, friable, calcareous loam having accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light gray and pale yellow, mottled, calcareous loam.

Included with these soils in mapping are small areas of Stickney and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. Stickney soils have a sodium affected subsoil. They are in swales and on toe slopes. Tetonka soils are poorly drained and are in depressions.

The content of organic matter is moderate and fertility medium in the Clarno soil. Both the content of organic matter and fertility are low in the Ethan soil and high in the Prosper soil. Permeability is moderate in the subsoil of all three soils and moderately slow in the underlying material. Available water capacity is high. The Prosper soil has a seasonal water table at a depth of 3 to 6 feet. Runoff is medium on all of the soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops. The main concerns of management are controlling erosion and conserving moisture. Increasing the content of organic matter and improving fertility also are concerns in areas of the Ethan soil. Planting and harvesting are delayed in areas of the Prosper soil during some wet periods. Minimizing tillage, leaving crop residue on the surface, and including

grasses and legumes in the cropping system help to control erosion, conserve moisture, increase the content of organic matter, and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but the slopes in some areas are too short or too irregular for contouring and terracing.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, smooth brome grass, crested wheatgrass, and pubescent wheatgrass grow well.

These soils are well suited to range. The native vegetation dominantly is green needlegrass and western wheatgrass on the Clarno and Ethan soils and big bluestem on the Prosper soil. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils are fairly well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well on the Clarno and Prosper soils. Trees that can grow well in areas where the supply of moisture is high are especially well suited to the Prosper soil. No trees or shrubs grow well on the Ethan soil; optimum survival and vigor are unlikely.

Because the Prosper soil is subject to flooding, the Clarno and Ethan soils are better suited to building site development. Their shrink-swell potential, however, is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Clarno and Ethan soils are well suited and the Prosper soil poorly suited to most sanitary facilities. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste in the Clarno and Ethan soils.

The Clarno soil is in capability subclass IIe, Silty range site; the Ethan soil is in capability subclass IIIe, Silty range site; the Prosper soil is in capability subclass IIc, Overflow range site.

#### **CpA—Clarno-Prosper loams, 0 to 2 percent slopes.**

These deep, nearly level soils are in areas on uplands where slopes generally are long and smooth and the drainage pattern is poorly defined. The well drained Clarno soil is on slightly convex rises. The moderately well drained Prosper soil is in swales. It is occasionally flooded by runoff from the Clarno soil. Areas are 5 to several hundred acres in size and are irregular in shape. They are 65 to 75 percent Clarno soil and 20 to 30 percent Prosper soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 9 inches thick. The subsoil is friable loam about 21 inches thick. The upper part is dark grayish brown, and the lower part is pale olive, is calcareous, and has spots and streaks of lime that extend into the underlying material. The underlying

material to a depth of 60 inches is pale yellow and pale olive, calcareous loam and clay loam. It has accumulations of carbonate in the upper part. In places the subsoil contains more clay. In some areas the underlying material is stratified silt and very fine sand. In other areas the surface layer is calcareous.

Typically, the surface layer of the Prosper soil is dark gray loam about 12 inches thick. The subsoil is about 23 inches thick. The upper part is dark grayish brown and grayish brown, friable clay loam. The lower part is light brownish gray, friable, calcareous loam having accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light gray and pale yellow, mottled, calcareous loam.

Included with these soils in mapping are small areas of Stickney and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The moderately well drained Stickney soils are along some of the swales. They have a sodium affected subsoil. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate in the Clarno soil and high in the Prosper soil. Fertility is medium in the Clarno soil and high in the Prosper soil. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. The Prosper soil has a seasonal water table at a depth of 3 to 6 feet. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, smooth brome grass, foxtail barley, and crested wheatgrass. The main concerns in managing cultivated areas are conserving moisture, increasing the content of organic matter, and improving fertility. Planting and harvesting are delayed in areas of the Prosper soil during some wet periods. Leaving crop residue on the surface and including grasses and legumes in the cropping system conserve moisture, increase the content of organic matter, and improve fertility.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. The trees that grow well in areas where the supply of moisture is high are especially well suited to the Prosper soil.

These soils are well suited to range. The native vegetation dominantly is green needlegrass, western wheatgrass, and big bluestem. Overused areas are dominated by Kentucky bluegrass and blue grama.

Because the Prosper soil is subject to flooding, the Clarno soil is better suited to building site development. Its shrink-swell potential, however, is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Clarno soil is well suited and the Prosper soil poorly suited to most sanitary facilities. Enlarging the

absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste in the Clarno soil.

The capability subclass is IIc; the Clarno soil in Silty range site, the Prosper soil in Overflow range site.

**CsA—Clarno-Stickney-Prosper loams, 0 to 3 percent slopes.** These deep, nearly level soils are on uplands dissected by very poorly defined drainageways. The well drained Clarno soil is on the higher convex parts of the landscape. The moderately well drained Stickney soil is in an intermediate position between the Clarno and Prosper soils. The moderately well drained Prosper soil is in swales. It is occasionally flooded. Areas are 5 to 625 acres in size and are irregular in shape. They are 45 to 55 percent Clarno soil, 20 to 30 percent Stickney soil, and 15 to 25 percent Prosper soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 9 inches thick. The subsoil is friable loam about 21 inches thick. The upper part is dark grayish brown, and the lower part is pale olive, is calcareous, and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow and pale olive, calcareous loam and clay loam. It has accumulations of carbonate in the upper part. In places the underlying material is stratified silt and very fine sand. In some areas the subsoil contains more clay. In other areas the surface layer is calcareous.

Typically, the surface layer of the Stickney soil is very dark gray loam about 6 inches thick. The subsurface layer is gray, very friable silt loam about 5 inches thick. The subsoil is about 23 inches thick. It is dark grayish brown silty clay loam over very dark gray, grayish brown, and light yellowish brown clay loam. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous loam. In places, the surface layer is less than 6 inches thick and the subsoil has columnar structure.

Typically, the surface layer of the Prosper soil is dark gray loam about 12 inches thick. The subsoil is about 23 inches thick. The upper part is dark grayish brown and grayish brown, friable clay loam. The lower part is light brownish gray, friable, calcareous loam having accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light gray and pale yellow, mottled, calcareous loam.

Included with these soils in mapping are small areas of Tetonka soils. These included soils make up less than 15 percent of any one mapped area. They are poorly drained and are in depressions.

The content of organic matter is moderate in the Clarno and Stickney soils and high in the Prosper soil. Fertility is medium in the Clarno and Stickney soils and high in the Prosper soil. Permeability is moderate in the subsoil of the Clarno and Prosper soils and moderately

slow in the underlying material. It is slow in the Stickney soil. Available water capacity is high in all three soils. The Prosper soil has a seasonal water table at a depth of 3 to 6 feet. Runoff is slow on all of the soils. The shrink-swell potential is moderate in the Clarno and Prosper soils and high in the Stickney soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, crested wheatgrass, smooth brome grass, and intermediate wheatgrass. Crop growth is uneven because it is somewhat restricted on the Stickney soil by droughtiness, a claypan subsoil, and a high content of sodium salts. The main concerns of management are conserving moisture and improving tilth. In some years spring planting and tillage are delayed by the flooding on the Prosper soil. Tillage practices that leave crop residue on the surface, inclusion of grasses and legumes in the cropping system, and timely tillage increase the content of organic matter, conserve moisture, and improve tilth.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees grow well. Those that grow well in areas where the supply of moisture is high are especially well suited to the Prosper soil.

These soils are well suited to range. The native vegetation dominantly is big bluestem, green needlegrass, and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

Because of the high shrink-swell potential of the Stickney soil and the flooding on the Prosper soil, the Clarno soil is better suited to building site development. Its moderate shrink-swell potential, however, is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps prevent this damage. Because of the very restricted permeability in the Stickney soil and the flooding on the Prosper soil, the Clarno soil is a better site for septic tank absorption fields. Its restricted permeability, however, is a limitation. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The Clarno soil is in capability subclass IIc, Silty range site; the Stickney soil is in capability subclass IIIs, Clayey range site; the Prosper soil is in capability subclass IIc, Overflow range site.

**DaB—Davis silt loam, 2 to 6 percent slopes.** This deep, well drained, gently sloping soil is on foot slopes and fans on uplands. Areas are about 5 to 135 acres in size and are irregular in shape. Slopes generally are smooth.

Typically, the surface layer is very dark gray silt loam about 17 inches thick. The subsoil is about 38 inches thick. It is very dark gray and grayish brown, friable loam and clay loam. The lower part is calcareous and has

spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown, calcareous loam having accumulations of lime. In places it is stratified fine and very fine sand.

Included with this soil in mapping are small areas of Clarno soils. These soils make up less than 15 percent of any one mapped area. They formed in glacial till. They are in convex areas.

The content of organic matter and fertility are high in the Davis soil. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is range. This soil is well suited to range. The native vegetation dominantly is green needlegrass, bluestems, and western wheatgrass. Overused areas are dominated by blue grama, needleandthread, and Kentucky bluegrass.

This soil is well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. The main concern in managing cultivated areas is controlling erosion. Contour farming, grassed waterways, and terraces help to control erosion. Leaving crop residue on the surface and including grasses and legumes in the cropping system increase the content of organic matter and conserve moisture.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, especially those that grow well in areas where the moisture supply is high.

This soil is fairly well suited to building site development and sanitary facilities. The moderate shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in septic tank absorption fields.

The capability subclass is IIe; Silty range site.

**DbA—DeGrey-Walke silt loams, 0 to 4 percent slopes.** These deep, nearly level and gently undulating soils are in areas on uplands where slopes generally are short and complex and drainageways are poorly defined. The moderately well drained DeGrey soil is in small, shallow depressions and on toe slopes. The well drained Walke soil is on very slight rises and on some toe slopes. Areas are 10 to several hundred acres in size and are irregular in shape. They are 45 to 55 percent DeGrey soil and 20 to 30 percent Walke soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the DeGrey soil is dark grayish brown silt loam about 6 inches thick. The

subsurface layer is grayish brown silt loam about 2 inches thick. The subsoil is about 17 inches thick. The upper part is dark grayish brown, very firm silty clay that has columnar structure, and the lower part is light olive brown, firm, calcareous silty clay loam that has spots and streaks of lime extending into the underlying material. The underlying material to a depth of 60 inches is light yellowish brown and olive, calcareous silty clay loam and clay loam. It has accumulations of lime in the upper part. In places the surface layer is less than 6 inches thick.

Typically, the surface layer of the Walke soil is dark grayish brown silt loam about 7 inches thick. Below this is a transitional layer of dark gray and gray silt loam about 4 inches thick. The subsoil is dark grayish brown and grayish brown, firm silty clay about 21 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam that has common nests of gypsum.

Included with these soils in mapping are small areas of Eakin, Highmore, Hoven, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. Eakin and Highmore soils are on the higher parts of the landscape. They do not have a sodium affected subsoil. Hoven and Tetonka soils are in depressions and are poorly drained.

The content of organic matter is moderate and fertility medium in the DeGrey and Walke soils. Permeability is slow in the DeGrey soil and moderately slow or slow in the Walke soil. Available water capacity is high in both soils. Runoff is medium. The shrink-swell potential is high.

Most of the acreage is cropland. These soils are poorly suited to cultivated crops. The best suited crops are those that are tolerant of drought and sodium salts. Early maturing small grain is better suited than corn. The main concerns of management are improving tilth, increasing the rate of water intake, and conserving moisture. Deep chiseling and subsoiling help to break up the dense claypan subsoil and increase the rate of water intake for a short time. Leaving crop residue on the surface, including grasses and legumes in the cropping system, and applying animal manure conserve moisture and improve tilth. Planting green manure crops also improves tilth and increases the content of organic matter.

These soils are fairly well suited to tame pasture and hay. Only those species that can grow in a soil that has a claypan and contains sodium salts are suitable. Alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are examples.

The DeGrey soil is poorly suited to windbreaks and environmental plantings. Optimum growth, survival, and vigor are not likely. The trees and shrubs can grow successfully on the Walke soil.

These soils are fairly well suited to range. The native vegetation dominantly is western wheatgrass, green needlegrass, and blue grama. Overused areas are

dominated by blue grama and saltgrass interspersed with bare spots.

These soils are fairly well suited to most kinds of building site development. The shrink-swell potential is a limitation. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the restricted permeability, these soils are poorly suited to septic tank absorption fields. These fields generally do not function well unless they are greatly enlarged. Sewage lagoons are a suitable alternative sewage disposal system.

The DeGrey soil is in capability subclass IVs, Claypan range site; the Walke soil is in capability subclass IIIs, Clayey range site.

**DeA—Delmont loam, 0 to 2 percent slopes.** This somewhat excessively drained, nearly level soil is on uplands and high stream terraces. It is shallow over gravelly sand. Areas are 10 to several hundred acres in size and are irregular in shape. Slopes generally are smooth.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is very dark grayish brown, very friable loam about 10 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In some areas the gravelly sand is within a depth of 14 inches. In other areas it is below a depth of 20 inches.

Included with this soil in mapping are small areas of Clarno, Prosper, and Tetonka soils. These soils make up less than 15 percent of any one mapped area. Clarno and Prosper soils are not underlain by gravelly sand. Clarno soils are in positions on the landscape similar to those of the Delmont soil. The moderately well drained Prosper soils are in swales. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate and fertility medium in the Delmont soil. Permeability is moderate or moderately rapid in the subsoil and rapid in the underlying material. Available water capacity is low. Runoff is slow.

Most areas are cultivated. This soil is poorly suited to cultivated crops because it is droughty. Measures that conserve moisture are the main management needs. Examples are leaving crop residue on the surface, planting green manure crops, and applying animal manure.

This soil is fairly well suited to tame pasture and hay. Only those grasses that are drought resistant are suitable. Crested wheatgrass and pubescent wheatgrass are examples.

This soil is fairly well suited to range. The native vegetation dominantly is needleandthread. Overused areas are dominated by threadleaf sedge and blue grama interspersed with bare spots.

This soil is poorly suited to windbreaks and environmental plantings. Trees or shrubs can be established, but optimum survival, growth, and vigor are unlikely.

This soil is well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. Septic tank absorption fields can function in this soil, but the effluent can pollute shallow ground water. The soil is a probable source of sand and gravel for use as road construction material.

The capability subclass is IVs; Shallow to Gravel range site.

#### **DIB—Delmont-Enet loams, 2 to 6 percent slopes.**

These undulating soils are in areas on uplands and high stream terraces where slopes generally are short and complex. The somewhat excessively drained Delmont soil generally is on the smooth and convex upper slopes. The well drained Enet soil generally is on the lower side slopes. Areas are 4 to 60 acres in size and are irregular in shape. They are 50 to 60 percent Delmont soil and 25 to 35 percent Enet soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 7 inches thick. The subsoil is very dark grayish brown, very friable loam about 10 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the gravelly sand is within a depth of 14 inches.

Typically, the surface layer of the Enet soil is very dark gray loam about 6 inches thick. The subsoil is about 23 inches thick. The upper part is very dark gray and dark grayish brown, very friable loam. The lower part is dark grayish brown, very friable sandy loam. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the gravelly sand is below a depth of 40 inches.

Included with these soils in mapping are small areas of Clarno, Henkin, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. Clarno soils are not underlain by gravelly sand. Henkin soils are more sandy in the upper part than the Delmont and Enet soils and do not have gravel in the underlying material. Clarno and Henkin soils are in positions on the landscape similar to those of the Delmont and Enet soils. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate in the Delmont and Enet soils. Fertility is medium. Permeability is moderately rapid or moderate in the subsoil of the Delmont soil and rapid in the underlying material. It is moderate in the subsoil of the Enet soil and rapid in the underlying material. Available water capacity is low in the Delmont soil and low or moderate in the Enet soil. Runoff is medium on both soils.

Most of the acreage is cropland. These soils are poorly suited to cultivated crops because they are

droughty. Small grain and grasses are better suited than late maturing crops, such as corn. Measures that control erosion, conserve moisture, increase the content of organic matter, and improve fertility are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system.

A cover of tame pasture plants or hay is effective in controlling erosion. These soils are fairly well suited to tame pasture and hay. Only those grasses that are drought resistant are suitable. Crested wheatgrass and pubescent wheatgrass are examples.

The Delmont soil is poorly suited and the Enet soil well suited to range. The native vegetation dominantly is needlegrasses and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass interspersed with bare spots.

These soils are poorly suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

These soils are well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. Septic tank absorption fields can function in these soils, but the effluent can pollute shallow ground water. The soils are a probable source of sand and gravel for use as road construction material.

The Delmont soil is in capability subclass IVe, Shallow to Gravel range site; the Enet soil is in capability subclass IIIe, Silty range site.

**DmC—Delmont-Talmo loams, 2 to 9 percent slopes.** These undulating and gently rolling soils are in areas on uplands where slopes generally are short and complex and poorly defined drainageways are typical. The somewhat excessively drained Delmont soil is on the sides and tops of the broader ridges. The excessively drained Talmo soil is on the steeper and more convex upper slopes. The Delmont soil is shallow over gravelly sand, and the Talmo soil is very shallow over gravelly sand. Areas are 5 to several hundred acres in size and are irregular in shape. They are 45 to 55 percent Delmont soil and 30 to 40 percent Talmo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 7 inches thick. The subsoil is very dark grayish brown, very friable loam about 10 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the gravelly sand is below a depth of 20 inches.

Typically, the surface layer of the Talmo soil is very dark gray loam about 6 inches thick. Below this is a transitional layer of grayish brown gravelly sand about 2 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. It has accumulations of lime in the upper part.

Included with these soils in mapping are small areas of Arlo, Henkin, Tetonka, and Worthing soils. These included soils make up less than 20 percent of any one mapped area. The very poorly drained Arlo soils are on the edges of swales. Henkin soils are more sandy in the upper part than the Delmont and Talmo soils and do not have gravel in the underlying material. They generally are on the lower parts of the landscape. The poorly drained Tetonka soils are in depressions. The very poorly drained Worthing soils are in the more deeply entrenched depressions.

The content of organic matter is moderate in the Delmont and Talmo soils. Fertility is medium in the Delmont soil and low in the Talmo soil. Permeability is moderate or moderately rapid in the subsoil of the Delmont soil and rapid in the underlying material. It is rapid in the Talmo soil. Available water capacity is low or very low in both soils. Runoff is medium on the Delmont soil and slow on the Talmo soil.

Most of the acreage is range. These soils are fairly well suited to range. The native vegetation dominantly is needleandthread and grama grasses. Overused areas are dominated by blue grama, threadleaf sedge, and weeds. If the range is severely overgrazed, the surface is bare in spots.

Because they are droughty, these soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings and are poorly suited to tame pasture and hay. Some trees and shrubs can be established for special purposes if they are planted by hand and given special care.

These soils are fairly well suited to most kinds of building site development. The sides of shallow excavations tend to cave in unless they are shored. Land shaping is needed in some of the steeper areas of the Talmo soil. Septic tank absorption fields can function in these soils, but the effluent can pollute shallow ground water. The soils are a probable source of sand and gravel for use as road construction material.

The Delmont soil is in capability subclass IVe, Shallow to Gravel range site; the Talmo soil is in capability subclass VIe, Very Shallow range site.

**Do—Dimo loam.** This somewhat poorly drained, nearly level soil is in swales and drainageways on uplands. It is occasionally flooded by runoff from the adjacent uplands. It is moderately deep over gravelly sand. Areas are 10 to 100 acres in size and are long and narrow.

Typically, the surface layer is very dark gray loam about 7 inches thick. The subsoil is about 21 inches thick. It is very dark gray and dark gray, very friable loam over dark grayish brown, mottled, calcareous sandy loam. The underlying material to a depth of 60 inches is multicolored gravelly sand. In places the gravelly sand is within a depth of 20 inches. In some areas glacial till is below a depth of 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Bon soils. These soils make

up less than 15 percent of any one mapped area. They do not have gravelly sand within a depth of 40 inches.

The content of organic matter and fertility are high in the Dimo soil. Permeability is moderate in the subsoil and rapid in the underlying material. Available water capacity is low or moderate. A seasonal high water table is at a depth of 2 to 6 feet. Runoff is slow. The shrink-swell potential is moderate in the surface layer and subsoil and low in the underlying material.

Most of the acreage is range. This soil is well suited to range. The native vegetation dominantly is big bluestem, western wheatgrass, and green needlegrass. Overused areas are dominated by Kentucky bluegrass and western wheatgrass.

This soil is fairly well suited to cultivated crops. It is well suited to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. Because the soil is somewhat droughty, conserving moisture for use late in the growing season is the main concern in managing cultivated areas. The best suited crops are those that mature early in the growing season. Leaving crop residue on the surface conserves moisture.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

Because of the high water table and the flooding, this soil generally is unsuitable as a site for buildings and sanitary facilities. It is a probable source of sand and gravel for use as road construction material.

The capability subclass is IIIs; Overflow range site.

#### **EaA—Eakin-Ethan complex, 0 to 3 percent slopes.**

These deep, well drained, nearly level soils are in areas on uplands where slopes generally are short and complex. The Eakin soil is in plane areas. The Ethan soil is on rises. Areas are 10 to 100 acres in size and are irregular in shape. They are 55 to 65 percent Eakin soil and 15 to 25 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eakin soil is dark grayish brown silt loam about 7 inches thick. The subsoil is brown and pale brown, very friable and friable silty clay loam about 26 inches thick. In the lower part it is calcareous and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale olive and light gray, calcareous loam and clay loam. In places glacial till is below a depth of 40 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Onita, Tetonka, and Walke soils. These included soils

make up less than 15 percent of any one mapped area. The moderately well drained Onita soils are in swales. They are dark to a depth of more than 20 inches. The poorly drained Tetonka soils are in depressions. Walke soils have a sodium affected subsoil. They are in slight depressions.

The content of organic matter is moderate and fertility medium in the Eakin soil. The content of organic matter and fertility are low in the Ethan soil. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops. The main concerns of management are conserving moisture and increasing the content of organic matter. Improving fertility also is a concern because the high content of lime in the surface layer of the Ethan soil adversely affects the availability of the plant nutrients. Leaving crop residue on the surface and including grasses and legumes in the cropping system conserve moisture, increase the content of organic matter, and improve fertility.

These soils are suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, smooth brome grass, crested wheatgrass, and pubescent wheatgrass are the best suited species.

These soils are fairly well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well on the Eakin soil. Trees and shrubs can be established on the Ethan soil, but optimum survival, growth, and vigor are unlikely.

These soils are well suited to range. The native vegetation dominantly is green needlegrass and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils are fairly well suited to most kinds of building site development and sanitary facilities. The shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

The Eakin soil is in capability subclass IIc, the Ethan soil in capability subclass IIIe; both soils are in Silty range site.

#### **EaB—Eakin-Ethan complex, 3 to 6 percent slopes.**

These deep, well drained, undulating soils are in areas on uplands where slopes generally are short and complex. The Eakin soil is on smooth side slopes and

the broader ridgetops, and the Ethan soil is on the convex shoulders of the ridges (fig. 6). Areas are 10 to several hundred acres in size and are irregular in shape. They are 55 to 65 percent Eakin soil and 20 to 30 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eakin soil is dark grayish brown silt loam about 7 inches thick. The subsoil is brown and pale brown, very friable and friable silty clay loam about 26 inches thick. In the lower part it is calcareous and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale olive and light gray, calcareous loam and clay loam. In places glacial till is below a depth of 40 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Onita, Tetonka, and Walke soils. These included soils

make up less than 20 percent of any one mapped area. The moderately well drained Onita soils are in swales. They are dark to a depth of more than 20 inches. The poorly drained Tetonka soils are in depressions. Walke soils have a sodium affected subsoil. They are in slight depressions.

The content of organic matter is moderate and fertility medium in the Eakin soil. The content of organic matter and fertility are low in the Ethan soil. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops. The main concerns of management are controlling erosion and conserving moisture. Increasing the content of organic matter and improving fertility are other concerns because the high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, increase the content of organic matter, and improve fertility. Contour farming, grassed waterways, and



Figure 6.—An area of Eakin-Ethan complex, 3 to 6 percent slopes.

terraces also can help to control erosion, but in some areas the slopes are too short or too irregular for contouring and terracing.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth brome grass are the best suited species.

These soils are fairly well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well on the Eakin soil. Trees and shrubs can be established on the Ethan soil, but optimum survival, growth, and vigor are unlikely.

These soils are well suited to range. The native vegetation dominantly is green needlegrass and western wheatgrass. Overused areas are dominated by blue grama, Kentucky bluegrass, and weeds.

These soils are fairly well suited to most kinds of building site development and sanitary facilities. The shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

The Eakin soil is in capability subclass IIe, the Ethan soil in capability subclass IIIe; both soils are in Silty range site.

#### **EaC—Eakin-Ethan complex, 6 to 9 percent slopes.**

These deep, well drained, gently rolling soils are in areas on uplands where slopes generally are short and complex. The Eakin soil is on smooth side slopes and the broader ridgetops. The Ethan soil is on the convex tops and shoulders of ridges. Areas are 5 to 95 acres in size and are irregular in shape. They are 50 to 60 percent Eakin soil and 25 to 35 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eakin soil is dark grayish brown silt loam about 7 inches thick. The subsoil is brown and pale brown, very friable and friable silty clay loam about 26 inches thick. In the lower part it is calcareous and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale olive and light gray, calcareous loam and clay loam. In places glacial till is below a depth of 40 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Onita and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The moderately well drained Onita soils are in swales. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate and fertility medium in the Eakin soil. The content of organic matter and fertility are low in the Ethan soil. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are fairly well suited to cultivated crops. The main concerns of management are controlling erosion and conserving moisture. Improving fertility also is a concern because the high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but in some areas slopes are too short or too irregular for contouring and terracing.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth brome grass are the best suited species.

These soils are fairly well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well on the Eakin soil. Trees and shrubs can be established on the Ethan soil, but optimum survival, growth, and vigor are unlikely.

These soils are well suited to range. The native vegetation dominantly is green needlegrass and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

Because of the slope and the shrink-swell potential, these soils are only fairly well suited to most kinds of building site development. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the slope and the restricted permeability, these soils are only fairly well suited to most sanitary facilities. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Land shaping and installation of the distribution lines across the slope generally improve the efficiency of the absorption field.

The Eakin soil is in capability subclass IIIe, the Ethan soil in capability subclass IVe; both soils are in Silty range site.

**EdA—Enet-Delmont loams, 0 to 2 percent slopes.**

These nearly level soils are in areas on uplands and stream terraces where slopes generally are long and smooth. The well drained Enet soil is in the more nearly level areas. The somewhat excessively drained Delmont soil is on low ridges and mounds. Areas are 10 to several hundred acres in size and are irregular in shape. They are 55 to 65 percent Enet soil and 25 to 35 percent Delmont soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Enet soil is very dark gray loam about 6 inches thick. The subsoil is about 23 inches thick. It is very dark gray and dark grayish brown, very friable loam in the upper part and dark grayish brown, very friable sandy loam in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the gravelly sand is below a depth of 40 inches.

Typically, the surface layer of the Delmont soil is very dark grayish brown loam about 7 inches thick. The subsoil is very dark grayish brown, very friable loam about 10 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the gravelly sand is within a depth of 14 inches.

Included with these soils in mapping are small areas of Clarno and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. Clarno soils are not underlain by gravelly sand. Their position on the landscape is similar to that of the Enet soil. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate and fertility medium in the Enet and Delmont soils. Permeability is moderate in the subsoil of the Enet soil and rapid in the underlying material. It is moderately rapid or moderate in the subsoil of the Delmont soil and rapid in the underlying material. Available water capacity is low or moderate in the Enet soil and low in the Delmont soil. Runoff is slow on both soils.

Most of the acreage is cropland. These soils are only fairly well suited to cultivated crops because they are droughty. Measures that conserve moisture, increase the content of organic matter, and improve fertility are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system.

These soils are fairly well suited to tame pasture and hay. Only those grasses that are drought resistant are suitable. Crested wheatgrass and pubescent wheatgrass are examples.

These soils are well suited to range. The native vegetation dominantly is needlegrasses and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils are poorly suited to windbreaks and environmental plantings. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

These soils are well suited to most kinds of building site development, but the sides of shallow excavations tend to cave in unless they are shored. Septic tank absorption fields can function in these soils, but the effluent can pollute shallow ground water. The soils are a probable source of sand and gravel for use as road construction material.

The Enet soil is in capability subclass IIIs, Silty range site; the Delmont soil is in capability subclass IVs, Shallow to Gravel range site.

**EtD—Ethan-Clarno loams, 9 to 15 percent slopes.**

These deep, well drained, strongly sloping soils are on uplands characterized by long, convex slopes and well defined drainageways. The Ethan soil is steeper than the Clarno soil and is higher on the landscape (fig. 7). Scattered glacial stones commonly are on the surface. Areas are 20 to 300 acres in size and generally are long and narrow. They are 40 to 50 percent Ethan soil and 25 to 35 percent Clarno soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Clarno soil is very dark grayish brown loam about 9 inches thick. The subsoil is friable loam about 21 inches thick. The upper part is dark grayish brown, and the lower part is pale olive, is calcareous, and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow and pale olive, calcareous loam and clay loam. It has accumulations of carbonate in the upper part. In places the underlying material is stratified silt and very fine sand.

Included with these soils in mapping are small areas of the moderately well drained Bon and Prosper soils. These included soils make up less than 15 percent of any one mapped area. They are in drainageways and swales.

The content of organic matter and fertility are low in the Ethan soil. The content of organic matter is moderate and fertility medium in the Clarno soil. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most areas support native grass. These soils are well suited to range. The native vegetation dominantly is green needlegrass, little bluestem, and western wheatgrass on the Ethan soil and green needlegrass and western wheatgrass on the Clarno soil. Overused areas are dominated by blue grama and Kentucky bluegrass.



Figure 7.—An area of Ethan-Clarno loams, 9 to 15 percent slopes. The Ethan soil is on the upper slopes, and the Clarno soil is on the lower side slopes.

These soils are fairly well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, smooth brome grass, and pubescent wheatgrass are suitable.

These soils generally are unsuited to windbreaks and environmental plantings and to cultivated crops because of the slope. Trees and shrubs can be planted on the Clarno soil for special uses, such as wildlife habitat.

Because of the shrink-swell potential and the slope, these soils are only fairly well suited to most kinds of building site development. Buildings should be designed to conform to the natural slope of the land. Land shaping is needed in some areas. Reseeding and shaping slopes that have been cut during construction can help to prevent excessive erosion. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the restricted permeability and the slope, these soils are only fairly well suited to sanitary facilities. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Land shaping and installation of the distribution

lines across the slope generally improve the efficiency of the absorption field.

The capability subclass is Vle; Silty range site.

**Fa—Farmsworth silt loam.** This deep, somewhat poorly drained, nearly level soil is on flood plains. It is subject to rare flooding. Areas are 10 to 80 acres in size and are irregular in shape.

Typically, the surface layer is dark gray silt loam about 3 inches thick. The subsurface layer is light gray silt loam about 2 inches thick. The subsoil is dark gray and grayish brown, very firm silty clay about 30 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam.

Included with this soil in mapping are small areas of the moderately well drained Bon, well drained Lane, and poorly drained Napa soils. These soils make up about 20 percent of any one mapped area. The Bon and Lane soils do not have a sodium affected subsoil. The Bon soils are near stream channels. The Lane soils are in positions on the landscape similar to those of the Farmsworth soil. The Napa soils are in the slightly lower convex areas.

Organic matter content is moderate and fertility medium in the Farmsworth soil. Tilth is poor. Permeability is slow or very slow. Available water capacity is moderate. A seasonal high water table is at a depth of 3 to 6 feet. Runoff is slow. The shrink-swell potential is high in the subsoil.

Most of the acreage is cropland. This soil is poorly suited to cultivated crops because of the sodium affected subsoil. Measures that improve tilth and conserve moisture are the main management needs. Examples are timely tillage, applications of manure, and tillage practices that leave crop residue on the surface.

This soil is fairly well suited to range. The native vegetation dominantly is western wheatgrass, blue grama, and green needlegrass. Overused areas are dominated by blue grama, buffalograss, and weeds interspersed with bare spots.

This soil is poorly suited to tame pasture and hay because of the dense claypan subsoil. Alfalfa, crested wheatgrass, intermediate wheatgrass, and pubescent wheatgrass are the best suited species.

This soil is poorly suited to windbreaks and environmental plantings because of the dense claypan subsoil and the adverse effect of the sodium on growth and survival. Optimum growth and survival are unlikely.

Because of the flooding, the wetness, and the high shrink-swell potential, this soil is poorly suited to building site development. It generally is unsuitable as a site for sanitary facilities because of the wetness and the restricted permeability.

The capability subclass is IVs; Claypan range site.

**HbA—Henkin-Blendon fine sandy loams, 0 to 2 percent slopes.** These deep, well drained, nearly level soils are on uplands and terraces. The Henkin soil is on slight rises. The Blendon soil is on the lower parts of the landscape. Areas are 10 to several hundred acres in size and are irregular in shape. They are 55 to 65 percent Henkin soil and 25 to 35 percent Blendon soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Henkin soil is very dark grayish brown fine sandy loam about 8 inches thick. The subsoil is very friable fine sandy loam about 18 inches thick. It is dark grayish brown and brown in the upper part and pale brown and calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown, calcareous fine and very fine sand.

Typically, the surface layer of the Blendon soil is very dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown, very friable fine sandy loam about 6 inches thick. The subsoil is dark grayish brown, very friable fine sandy loam about 21 inches thick. The underlying material to a depth of 60 inches is grayish brown and brown loamy fine sand. In places glacial till or sand is below a depth of 50 inches.

Included with these soils in mapping are small areas of Delmont, Eakin, and Enet soils. These included soils

make up less than 20 percent of any one mapped area. Delmont and Enet soils are underlain by gravelly sand. They occur as scattered convex areas. Eakin soils formed in silty material overlying loamy glacial till. They are on the sides of slightly convex ridges.

The content of organic matter is moderate and fertility medium in the Henkin and Blendon soils. Permeability is moderately rapid. Available water capacity is low or moderate. Runoff is slow.

Most of the acreage is cropland. These soils are fairly well suited to cultivated crops. They are well suited to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. The main concerns in managing cultivated areas are controlling soil blowing and conserving moisture. Minimizing tillage and leaving crop residue on the surface help to control soil blowing, conserve moisture, and improve fertility. Wind strip cropping and field windbreaks also help to control soil blowing.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

These soils are well suited to range. The native vegetation dominantly is bluestems and prairie sandreed. Overused areas are dominated by Kentucky bluegrass and blue grama.

These soils are well suited to most kinds of building site development, but the sides of shallow excavations in the Blendon soil tend to cave in unless they are shored. Septic tank absorption fields function well in these soils, but seepage is a limitation if other sanitary facilities are installed.

The capability subclass is IIIe; Sandy range site.

**HbB—Henkin-Blendon fine sandy loams, 2 to 6 percent slopes.** These deep, well drained, undulating soils are in areas on uplands where slopes generally are short and complex. The Henkin soil is on the convex mid and upper slopes on the broader, higher parts of the landscape. The Blendon soil is on the lower side slopes and in swales. Areas are 20 to more than 100 acres in size and are irregular in shape. They are 55 to 65 percent Henkin soil and 20 to 30 percent Blendon soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Henkin soil is very dark grayish brown fine sandy loam about 8 inches thick. The subsoil is very friable fine sandy loam about 18 inches thick. It is dark grayish brown and brown in the upper part and pale brown and calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown, calcareous very fine sand and fine sand. In some areas gravel is below a depth of 40 inches. In other areas glacial till is below a depth of 40 inches.

Typically, the surface layer of the Blendon soil is very dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown, very friable fine sandy loam about 6 inches thick. The subsoil

is dark grayish brown, very friable fine sandy loam about 21 inches thick. The underlying material to a depth of 60 inches is grayish brown and brown loamy fine sand. In places it is sand and gravel or is glacial till.

Included with these soils in mapping are small areas of Delmont, Enet, and Tetonka soils and, on rises, a soil that has lime in the surface layer. These included soils make up less than 25 percent of any one mapped area. Delmont and Enet soils are underlain by gravelly sand. Their position on the landscape is similar to that of the Henkin soil. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate and fertility medium in the Henkin and Blendon soils. Permeability is moderately rapid. Available water capacity is low or moderate. Runoff is medium.

Most of the acreage is cropland. These soils are fairly well suited to cultivated crops. They are well suited to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. The main concerns in managing cultivated areas are controlling soil blowing and conserving moisture. Minimizing tillage and leaving crop residue on the surface help to control erosion and soil blowing, conserve moisture, and improve fertility. Wind strip cropping and field windbreaks also help to control soil blowing.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

These soils are well suited to range. The native vegetation dominantly is bluestems and prairie sandreed. Overused areas are dominated by Kentucky bluegrass and blue grama.

These soils are well suited to most kinds of building site development, but the sides of shallow excavations in the Blendon soil tend to cave in unless they are shored. Septic tank absorption fields function well in these soils, but seepage is a limitation if other sanitary facilities are installed.

The capability subclass is IIIe; Sandy range site.

**HeA—Highmore-Eakin silt loams, 0 to 2 percent slopes.** These deep, well drained, nearly level soils are on uplands that generally are dissected by well defined drainageways. The Highmore soil is on the broader flats. The Eakin soil is on slight rises. Most slopes are long and smooth, but some are short and complex. Areas are 5 to several hundred acres in size and are irregular in shape. They are 50 to 60 percent Highmore soil and 25 to 35 percent Eakin soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Highmore soil is dark grayish brown silt loam about 9 inches thick. The subsoil is dark grayish brown and light yellowish brown, friable silty clay loam about 24 inches thick. In the lower part it is calcareous and has spots and streaks of lime that

extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, calcareous silt loam and loam.

Typically, the surface layer of the Eakin soil is dark grayish brown silt loam about 7 inches thick. The subsoil is brown and pale brown, very friable and friable silty clay loam about 26 inches thick. In the lower part it is calcareous and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale olive and light gray, calcareous loam and clay loam. In places glacial till is within a depth of 20 inches.

Included with these soils in mapping are small areas of Clarno, DeGrey, Ethan, Onita, Tetonka, and Walke soils. These included soils make up less than 25 percent of any one mapped area. Clarno soils are near drainageways. Their subsoil contains more sand and less silt than that of either the Highmore or Eakin soil. DeGrey and Walke soils have a sodium affected subsoil. They are in slight depressions. Ethan soils are on the higher convex parts of the landscape. They have lime near the surface. Onita soils are in swales. They are dark to a depth of more than 20 inches. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate and fertility medium in the Highmore and Eakin soils. Permeability is moderate in the upper part of these soils and moderately slow in the lower part. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops (fig. 8) and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. Measures that conserve moisture are the main management needs in cultivated areas. An example is leaving crop residue on the surface.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

These soils are well suited to range. The native vegetation dominantly is green needlegrass and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils are fairly well suited to most kinds of building site development and sanitary facilities. The shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

The capability subclass is IIc; Silty range site.

**HeB—Highmore-Eakin silt loams, 2 to 6 percent slopes.** These deep, well drained, undulating soils are



Figure 8.—An area of Highmore-Eakin silt loams, 0 to 2 percent slopes, used for small grain.

on uplands. The Highmore soil is on smooth side slopes and the broader ridgetops. The Eakin soil is on the higher convex slopes. Most slopes are long and smooth, but some are short and complex. Areas are 20 to several hundred acres in size and are irregular in shape. They are 45 to 55 percent Highmore soil and 35 to 45 percent Eakin soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Highmore soil is dark grayish brown silt loam about 9 inches thick. The subsoil is dark grayish brown and light yellowish brown, friable silty clay loam about 24 inches thick. In the lower part it is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, calcareous silt loam and loam.

Typically, the surface layer of the Eakin soil is dark grayish brown silt loam about 7 inches thick. The subsoil is brown and pale brown, very friable and friable silty clay loam about 26 inches thick. In the lower part it is calcareous and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale olive

and light gray, calcareous loam and clay loam. In places glacial till is within a depth of 20 inches.

Included with these soils in mapping are small areas of DeGrey, Ethan, Hoven, Onita, Tetonka, and Walke soils. These included soils make up less than 25 percent of any one mapped area. DeGrey, Hoven, and Walke soils have a sodium affected subsoil. DeGrey and Walke soils are in slight depressions. Ethan soils have lime near the surface. They are on the higher convex parts of the landscape. Onita soils are dark to a depth of more than 20 inches. They are in swales. The poorly drained Tetonka and Hoven soils are in depressions.

The content of organic matter is moderate and fertility medium in the Highmore and Eakin soils. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, green needlegrass, intermediate wheatgrass, and smooth brome grass. Measures that control erosion and conserve moisture are the main

management needs. Examples are minimizing tillage and leaving crop residue on the surface. Contour farming, grassed waterways, and terraces also can help to control erosion, but the slopes in some areas are too short or too irregular for contouring and terracing.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

These soils are well suited to range. The native vegetation dominantly is needlegrass and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils are fairly well suited to most kinds of building site development and sanitary facilities. The shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

The capability subclass is IIe; Silty range site.

**HgA—Highmore-Walke silt loams, 0 to 3 percent slopes.** These deep, well drained, nearly level soils are in areas on uplands where smooth slopes and poorly defined drainageways are typical. The Highmore soil is on the higher parts of the landscape. The Walke soil is on the plane or slightly concave parts. Areas are 5 to several hundred acres in size and are irregular in shape. They are 45 to 55 percent Highmore soil and 35 to 45 percent Walke soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Highmore soil is dark grayish brown silt loam about 9 inches thick. The subsoil is dark grayish brown and light yellowish brown, friable silty clay loam about 24 inches thick. In the lower part it is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 60 inches is pale yellow, calcareous silt loam and loam. In places loamy glacial till is 20 to 40 inches from the surface.

Typically, the surface layer of the Walke soil is dark grayish brown silt loam about 7 inches thick. Below this is a transitional layer of dark gray and gray silt loam about 4 inches thick. The subsoil is dark grayish brown and grayish brown, firm silty clay about 21 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous clay loam that has seams and nests of gypsum. In places glacial till is below a depth of 40 inches.

Included with these soils in mapping are small areas of Ethan, Onita, and Tetonka soils. These included soils

make up less than 20 percent of any one mapped area. Ethan soils have lime near the surface. They are on rises. The moderately well drained Onita soils are in swales. They are dark to a depth of more than 20 inches. The poorly drained Tetonka soils are in depressions.

The content of organic matter is moderate and fertility medium in the Highmore and Walke soils. Permeability is moderate in the upper part of the Highmore soil and moderately slow in the lower part. It is moderately slow or slow in the Walke soil. Tilth is poor in the Walke soil. Available water capacity is high in both soils. Runoff is slow. The shrink-swell potential is moderate in the Highmore soil. It is high in the subsoil of the Walke soil and moderate in the underlying material.

Most of the acreage is cropland. These soils are fairly well suited to cultivated crops. They are well suited to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. Crop growth is uneven because it is restricted on the Walke soil. The main concerns in managing cultivated areas are conserving moisture and improving tilth. Leaving crop residue on the surface and including grasses and legumes in the cropping system conserve moisture, improve tilth and fertility, and increase the content of organic matter.

These soils are fairly well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow fairly well. Tree growth is slightly restricted on the Walke soil.

These soils are well suited to range. The native vegetation dominantly is green needlegrass, western wheatgrass, and, on the Highmore soil, lesser amounts of bluestems and sideoats grama. Overused areas are dominated by blue grama and Kentucky bluegrass.

The Highmore soil is better than the Walke soil as a site for buildings. Because of the high shrink-swell potential, the Walke soil provides an unstable base for buildings. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the restricted permeability, the Highmore soil is only fairly well suited to septic tank absorption fields. Enlarging the absorption area in these fields helps to overcome the slow absorption of liquid waste. The fields do not function properly in the Walke soil because of the very restricted permeability.

The Highmore soil is in capability subclass IIc, Silty range site; the Walke soil is in capability subclass IIIs, Clayey range site.

**HhB—Homme silty clay loam, 2 to 6 percent slopes.** This deep, well drained, undulating soil is on uplands. Areas are 5 to 80 acres in size and are irregular in shape. Slopes generally are smooth.

Typically, the surface layer is dark grayish brown silty clay loam about 10 inches thick. The subsoil is friable

silty clay loam about 27 inches thick. The upper part is brown, and the lower part is pale brown, is calcareous, and has accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is very pale brown and pale yellow, calcareous silty clay loam and clay loam. In places the soil is dark to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Ethan and Walke soils. These soils make up less than 15 percent of any one mapped area. Ethan soils have lime near the surface and contain more sand and less clay in the subsoil than the Homme soil. They are on the higher rises and on the shoulders of ridges. Walke soils have a sodium affected subsoil. They are in plane areas.

The content of organic matter is moderate and fertility medium in the Homme soil. Permeability is moderately slow. Available water capacity is high. Runoff is medium. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Nearly all of the acreage is cropland. This soil is well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. Measures that help to control erosion and conserve moisture are the main management needs in cultivated areas. Examples are minimizing tillage and leaving crop residue on the surface. Contour farming, grassed waterways, and terraces also can help to control erosion, but in some areas the slopes are too short or too irregular for contouring and terracing.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

This soil is well suited to range. The native vegetation dominantly is bluestems and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

This soil is fairly well suited to most kinds of building site development and sanitary facilities. The shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

The capability subclass is IIe; Silty range site.

**HmB—Homme-Ethan complex, 1 to 6 percent slopes.** These deep, well drained, undulating soils are in areas on uplands where slopes generally are short and complex. The Homme soil is on smooth side slopes and broad ridgetops. The Ethan soil is on the convex shoulders of ridges. Areas are 10 to 80 acres in size and are irregular in shape. They are 55 to 65 percent Homme

soil and 20 to 30 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 27 inches thick. The upper part is brown, and the lower part is pale brown, is calcareous, and has accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is very pale brown and pale yellow, calcareous silty clay loam and clay loam. In places the soil is dark to a depth of more than 20 inches.

Typically, the surface layer of the Ethan soil is dark grayish brown, calcareous loam about 5 inches thick. The subsoil is dark grayish brown and very pale brown, very friable and friable, calcareous loam about 22 inches thick. The underlying material to a depth of 60 inches is pale olive and light yellowish brown, mottled, calcareous clay loam that has accumulations of lime. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Walke soils. These included soils make up less than 15 percent of any one mapped area. They have a sodium affected subsoil. They are in slight depressions.

The content of organic matter is moderate in the Homme soil and low in the Ethan soil. Fertility is medium in the Homme soil and low in the Ethan soil. Permeability is moderately slow in the Homme soil. It is moderate in the subsoil of the Ethan soil and moderately slow in the underlying material. Available water capacity is high in both soils. Runoff is medium. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is moderate in the Ethan soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops. The main concerns of management are controlling erosion and conserving moisture. Improving fertility also is a concern because the high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Contour farming, grassed waterways, and terraces also can help to control erosion, but slopes generally are too short or too irregular for contouring and terracing.

These soils are well suited to tame pasture and hay. All climatically suited pasture plants grow well on the Homme soil, but they do not grow so well on the Ethan soil because of the high content of carbonates. Alfalfa, intermediate wheatgrass, and smooth brome grass are the best suited species.

These soils are fairly well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well on the Homme soil. Trees or shrubs can be established on the

Ethan soil, but optimum survival, growth, and vigor are unlikely.

These soils are well suited to range. The native vegetation dominantly is bluestems, needlegrasses, and western wheatgrass. Overused areas are dominated by blue grama and Kentucky bluegrass.

These soils are fairly well suited to most kinds of building site development and sanitary facilities. The shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

The Homme soil is in capability subclass IIe, the Ethan soil in capability subclass IIIe; both soils are in Silty range site.

**HnA—Homme-Onita silty clay loams, 0 to 2 percent slopes.** These deep, nearly level soils are on uplands. The well drained Homme soil is on slight rises. The moderately well drained Onita soil is on flats and in swales. Areas are 5 to several hundred acres in size and are irregular in shape. They are 55 to 65 percent Homme soil and 20 to 30 percent Onita soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Homme soil is dark grayish brown silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 27 inches thick. The upper part is brown, and the lower part is pale brown, is calcareous, and has accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is very pale brown and pale yellow, calcareous silty clay loam and clay loam.

Typically, the surface layer of the Onita soil is very dark grayish brown silty clay loam about 15 inches thick. The subsoil is about 23 inches of dark grayish brown and grayish brown, friable and firm silty clay and silty clay loam. The underlying material to a depth of 60 inches is light olive brown, mottled silty clay loam and light yellowish brown, mottled clay loam.

Included with these soils in mapping are small areas of Ethan, Tetonka, and Walke soils. These included soils make up less than 15 percent of any one mapped area. Ethan soils have lime near the surface and contain more sand and less clay in the subsoil than the Homme and Onita soils. They are on slight rises. The poorly drained Tetonka soils are in depressions. Walke soils have a sodium affected subsoil. They are in slight depressions.

The content of organic matter is moderate in the Homme soil and high in the Onita soil. Fertility is medium in the Homme soil and high in the Onita soil. Permeability is moderately slow in both soils. Available

water capacity is high. Runoff is slow. The shrink-swell potential is high in the subsoil of the Homme soil and moderate in the underlying material. It is high in the Onita soil.

Most of the acreage is cropland. These soils are well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. The main concerns in managing cultivated areas are conserving moisture and improving fertility. Leaving crop residue on the surface and including grasses and legumes in the cropping system conserve moisture, improve fertility, and increase the content of organic matter.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

These soils are well suited to range. The native vegetation dominantly is bluestems, western wheatgrass, and green needlegrass. Overused areas are dominated by Kentucky bluegrass and blue grama.

These soils are fairly well suited to most kinds of building site development and sanitary facilities. The shrink-swell potential is a limitation on building sites, and the restricted permeability is a limitation in septic tank absorption fields. Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

The capability subclass is IIc; Silty range site.

**Hv—Hoven silt loam.** This deep, poorly drained, level soil is in depressions in the uplands. It is ponded during periods of snowmelt and heavy rainfall. Areas are 3 to 50 acres in size and generally are circular.

Typically, the surface layer is gray silt loam about 5 inches thick. The subsoil is dark gray, very firm silty clay about 27 inches thick. The underlying material to a depth of 60 inches is gray and brown, calcareous clay loam.

Included with this soil in mapping are small areas of Onita and Tetonka soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Onita soils are in swales. The Tetonka soils do not have a sodium affected subsoil. They are in positions on the landscape similar to those of the Hoven soil.

The content of organic matter is moderate and fertility medium in the Hoven soil. Permeability is very slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1.5 feet part of the year. As much as 1.0 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native grass. This soil is fairly well suited to range. The native vegetation dominantly is western wheatgrass. Overused areas are dominated by

saltgrass and weeds. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. It is only fairly well suited to tame pasture and hay because the ponding and the sodium salts severely limit the number of suitable species. Garrison creeping foxtail and western wheatgrass are suitable.

This soil generally is unsuitable as a site for buildings and most sanitary facilities because of the ponding.

The capability subclass is VI<sub>s</sub>; Closed Depression range site.

**La—Lane silty clay loam.** This deep, well drained, nearly level soil is on terraces and foot slopes. Areas are 10 to several hundred acres in size and are irregular in shape. Slopes are smooth and slightly concave.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is very dark gray and grayish brown, firm silty clay about 34 inches thick. The underlying material to a depth of 60 inches is grayish brown and light brownish gray, calcareous silty clay loam. In places the depth to free carbonates is more than 22 inches. In some areas sand and gravel are below a depth of 40 inches.

Included with this soil in mapping are small areas of Beadle, Bon, and Hoven soils. These soils make up less than 20 percent of any one mapped area. Beadle soils are dark to a depth of less than 20 inches. They are on uplands. The moderately well drained Bon soils are in positions on the landscape similar to those of the Lane soil. Their subsoil contains less clay than that of the Lane soil. The poorly drained Hoven soils are in depressions.

The content of organic matter and fertility are high in the Lane soil. Tilth is fair. Permeability is moderately slow or slow. Available water capacity is high. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. Conserving moisture, increasing the rate of water intake, and improving tilth are the main concerns in managing cultivated areas. Tilling when the soil is wet causes compaction in the subsoil. Leaving crop residue on the surface conserves moisture and improves fertility and tilth. Chiseling or subsoiling increases the water intake rate.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, all climatically suited trees and shrubs grow well.

This soil is well suited to range. The native vegetation dominantly is western wheatgrass and green needlegrass. Overused areas are dominated by western wheatgrass. After continued overuse, blue grama and weeds occupy the site.

Because of the shrink-swell potential, this soil is poorly suited to most kinds of building site development.

Backfilling with sandy material, providing foundation drains, and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

Because of the restricted permeability, this soil is poorly suited to septic tank absorption fields. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The capability subclass is II<sub>s</sub>; Clayey range site.

**Ma—Macken silty clay.** This deep, poorly drained, level soil is in depressions in the uplands. It is ponded during periods of snowmelt and heavy rainfall. Areas are 20 to several hundred acres in size and generally are circular. The surface is uneven because of small pits and mounds.

Typically, the surface layer is dark gray silty clay about 3 inches thick. The subsoil is gray and dark gray, firm silty clay about 30 inches thick. In the lower part it is calcareous and has accumulations of lime. The underlying material to a depth of 60 inches is light olive gray, calcareous silty clay and light gray, calcareous silty clay loam. In places the soil is very poorly drained.

Included with this soil in mapping are small areas of DeGrey, Eakin, and Lane soils. These soils make up less than 15 percent of any one mapped area. They are moderately well drained or well drained and are on the higher parts of the landscape. Also, DeGrey soils have a sodium affected subsoil.

The content of organic matter is high and fertility medium in the Macken soil. Permeability is slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1.0 foot part of the year. As much as 0.5 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native grasses and are used for grazing or hay. This soil is well suited to range. The native vegetation dominantly is western wheatgrass and sedges. Overused areas are dominated by sedges and smartweed during wet periods and by short grasses and weeds during dry periods.

This soil is well suited to wetland wildlife habitat if grazing animals are fenced out. Constructing shallow dugouts provides areas of open water for long periods.

This soil generally is unsuitable as a site for buildings and most sanitary facilities because of the ponding.

The capability subclass is III<sub>w</sub>, drained, V<sub>w</sub>, undrained; Closed Depression range site.

**Na—Napa silt loam.** This deep, poorly drained, nearly level soil is on flood plains. It is occasionally flooded. Areas are 40 to more than 100 acres in size. They generally are long and narrow and follow the contour of the stream.

Typically, the surface layer is gray silt loam about 1 inch thick. The subsoil is dark gray, firm silty clay about

28 inches thick. In the lower part it has common nests of gypsum. The underlying material to a depth of 60 inches is gray, light gray, and light olive gray, mottled, calcareous silty clay and silty clay loam.

Included with this soil in mapping are small areas of Bon, Farmsworth, and Lane soils. These soils make up 15 to 25 percent of any one mapped area. The moderately well drained Bon soils are near the stream channels. The somewhat poorly drained Farmsworth soils are on the slightly higher parts of the landscape. The well drained Lane soils are in positions on the landscape similar to those of the Napa soil. They do not have a sodium affected subsoil.

The content of organic matter is moderate and fertility low in the Napa soil. Permeability is very slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1 foot part of the year. Runoff is very slow. The shrink-swell potential is high.

Most of the acreage is range. This soil is fairly well suited to range. The native vegetation dominantly is western wheatgrass, cordgrass, alkaligrass, and saltgrass. Overused areas are dominated by saltgrass.

This soil is poorly suited to tame pasture and hay. The best suited pasture plants are tall wheatgrass and western wheatgrass.

This soil generally is not suited to cultivated crops, windbreaks and environmental plantings, building site development, and most sanitary facilities because of the flooding, the high content of toxic salts, the high shrink-swell potential, and the restricted permeability.

The capability subclass is VIw; Saline Lowland range site.

**Oa—Onita silt loam.** This deep, moderately well drained soil is in swales, along drainageways, and on foot slopes in the uplands. It is occasionally flooded. Areas are 10 to 80 acres in size and are long and narrow. Slopes are slightly concave.

Typically, the surface layer is very dark grayish brown silt loam about 15 inches thick. The subsoil is about 23 inches thick. It is dark grayish brown and grayish brown, friable and firm silty clay and calcareous silty clay loam. The underlying material to a depth of 60 inches is light olive brown, mottled, calcareous silty clay loam and light yellowish brown, mottled, calcareous clay loam.

Included with this soil in mapping are small areas of DeGrey, Highmore, Hoven, and Tetonka soils. These soils make up less than 15 percent of any one mapped area. DeGrey soils have a sodium affected subsoil. Highmore soils are well drained. DeGrey and Highmore soils are on the higher parts of the landscape. The poorly drained Hoven and Tetonka soils are in depressions.

The content of organic matter and fertility are high in the Onita soil. Permeability is moderately slow. Available water capacity is high. A seasonal high water table is at a depth of 2.5 to 6.0 feet during wet periods. Runoff is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Most of the acreage is cropland. This soil is well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, intermediate wheatgrass, and smooth brome grass. In some years fieldwork is delayed because of runoff from adjacent soils, but in most years the additional moisture is beneficial. Conserving moisture during dry periods is the main concern of management. Leaving crop residue on the surface and including grasses and legumes in the cropping system increase the content of organic matter and conserve moisture.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

This soil is well suited to range. The native vegetation dominantly is big bluestem and green needlegrass. Overgrazed areas are dominated by Kentucky bluegrass.

This soil generally is unsuitable as a site for buildings and most sanitary facilities because of the flooding and the wetness.

The capability subclass is IIc; Overflow range site.

**On—Onita-Tetonka silt loams.** These deep, level and nearly level soils are on uplands. The moderately well drained Onita soil is in swales. It is occasionally flooded. The poorly drained Tetonka soil is in the slightly lower depressions within the swales. It is ponded part of the year. Areas are 5 to 50 acres in size and are long and narrow. They are 50 to 60 percent Onita soil and 30 to 40 percent Tetonka soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Onita soil is very dark grayish brown silt loam about 15 inches thick. The subsoil is about 23 inches thick. It is dark grayish brown and grayish brown, friable and firm silty clay and silty clay loam. The underlying material to a depth of 60 inches is light olive brown and light yellowish brown, mottled silty clay loam and clay loam.

Typically, the surface layer of the Tetonka soil is dark gray silt loam about 7 inches thick. The subsurface layer is about 6 inches thick. It is light gray silt loam in the upper part and dark gray and gray silty clay loam in the lower part. The subsoil is about 23 inches of dark gray, very firm silty clay and silty clay loam. The underlying material to a depth of 60 inches is light gray clay loam.

Included with these soils in mapping are small areas of DeGrey, Highmore, Hoven, and Walke soils. These included soils make up less than 20 percent of any one mapped area. DeGrey, Hoven, and Walke soils have a sodium affected subsoil. Highmore soils are well drained. DeGrey, Highmore, and Walke soils are on the higher parts of the landscape. Hoven soils are in depressions.

The content of organic matter is high in the Onita soil and moderate in the Tetonka soil. Fertility is high in the Onita soil and medium in the Tetonka soil. Permeability is moderately slow in the Onita soil and very slow or slow in the Tetonka soil. Available water capacity is high in both soils. The Onita soil has a seasonal high water

table at a depth of 2.5 to 6.0 feet during wet periods. The Tetonka soil has a seasonal high water table within a depth of 1.0 foot part of the year. As much as 1.0 foot of water ponds on this soil during some wet periods. Runoff is slow on the Onita soil and ponded on the Tetonka soil. The shrink-swell potential is high in the subsoil of the Onita soil and moderate in the underlying material. It is high in the Tetonka soil.

Most of the acreage is cropland. These soils are fairly well suited to cultivated crops and to hay and tame pasture plants, such as alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth brome grass. Tilth and the ponding on the Tetonka soil are the main concerns in managing cultivated areas. Returning crop residue to the soil and delaying tillage when the soils are wet improve tilth. Surface drains and measures that divert the runoff from adjacent soils help to control the excess water.

These soils are well suited to range. The native vegetation dominantly is big bluestem on the Onita soil and sedges, prairie cordgrass, western wheatgrass, and reedgrasses on the Tetonka soil. Overused areas are dominated by Kentucky bluegrass.

The Onita soil is well suited to windbreaks and environmental plantings, but the Tetonka soil is poorly suited. All climatically suited trees and shrubs grow well on the Onita soil, but optimum growth and survival are unlikely on the Tetonka soil.

These soils generally are unsuitable as sites for buildings and most sanitary facilities because of the flooding and the ponding.

The Onita soil is in capability subclass IIc, Overflow range site; the Tetonka soil is in capability subclass IIw, drained, and in Wet Meadow range site.

**Pg—Pits, gravel.** These are open excavations, 5 to 30 feet deep, from which sand and gravel have been removed. They are irregular in shape and range from 2 to 50 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottoms to almost vertical on the rims. Some of the pit bottoms are covered with water.

The pit bottoms typically are sand and gravel, but they are loam or clay loam glacial till or silty glacial drift where all of the sand and gravel has been removed. Mounds of mixed loamy overburden are on the edges of the areas. The bottoms and sides support little or no vegetation during periods when the pits are used.

Most gravel pits are used only as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned gravel pits can be restored to range, tame pasture, or cropland if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden material as topsoil dressing. Applying fertilizer as needed helps to establish range or pasture.

The capability subclass is VIIIs; no range site is assigned.

**Pt—Prosper-Tetonka complex.** These deep, level and nearly level soils are on uplands. The moderately well drained Prosper soil is in swales. It is occasionally flooded. The poorly drained Tetonka soil is in the slightly lower depressions within the swales. It is ponded part of the year. Areas are 5 to 50 acres in size and are long and narrow. They are 55 to 65 percent Prosper soil and 25 to 35 percent Tetonka soil. The two soils occur as areas so closely intermingled or small that mapping them separately is not practical.

Typically, the surface layer of the Prosper soil is dark gray loam about 12 inches thick. The subsoil is about 23 inches thick. The upper part is dark grayish brown and grayish brown, friable clay loam. The lower part is light brownish gray, friable, calcareous loam having accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light gray and pale yellow, mottled, calcareous loam.

Typically, the surface layer of the Tetonka soil is dark gray silt loam about 7 inches thick. The subsurface layer is about 6 inches thick. It is light gray silt loam in the upper part and dark gray and gray silty clay loam in the lower part. The subsoil is about 23 inches of dark gray, very firm silty clay and silty clay loam. The underlying material to a depth of 60 inches is light gray clay loam.

Included with these soils in mapping are small areas of Clarno, Hoven, and Stickney soils. These included soils make up less than 20 percent of any one mapped area. The well drained Clarno soils are on the higher parts of the landscape. Stickney soils have a sodium affected subsoil. They are nearly level and are in areas having slight microrelief. The poorly drained Hoven soils are in depressions. They have a sodium affected subsoil.

The content of organic matter and fertility are high in the Prosper soil. The content of organic matter is moderate and fertility medium in the Tetonka soil. Permeability is moderate in the subsoil of the Prosper soil and moderately slow in the underlying material. It is very slow or slow in the Tetonka soil. Available water capacity is high in both soils. A seasonal high water table is at a depth of 3 to 6 feet in the Prosper soil and is within a depth of 1 foot in the Tetonka soil. As much as 1 foot of water ponds on the Tetonka soil during some wet periods. Runoff is slow on the Prosper soil and ponded on the Tetonka soil. The shrink-swell potential is moderate in the Prosper soil and high in the Tetonka soil.

Most of the acreage is cropland. If adequately drained, these soils are suited to cultivated crops. The main concern of management is the runoff from adjacent soils. Tilth also is a concern. Returning crop residue to the soil and delaying tillage when the soils are wet improve tilth. Surface drains and measures that divert the runoff from adjacent soils help to control the excess water.

These soils are fairly well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth brome grass are suitable.

The Prosper soil is well suited to windbreaks and environmental plantings, but the Tetonka soil is poorly suited. All climatically suited trees and shrubs grow well on the Prosper soil, but optimum growth and survival are unlikely on the Tetonka soil.

These soils are well suited to range. The native vegetation dominantly is big bluestem on the Prosper soil and sedges, prairie cordgrass, western wheatgrass, and reedgrasses on the Tetonka soil. Overused areas are dominated by Kentucky bluegrass.

These soils generally are not suitable as sites for buildings and most sanitary facilities because of the flooding and the ponding.

The Prosper soil is in capability subclass IIc, Overflow range site; the Tetonka soil is in capability subclass IIw, drained, and in Wet Meadow range site.

**TaC—Talgo gravelly sandy loam, 2 to 9 percent slopes.** This excessively drained, undulating and gently rolling soil is in abandoned gravel pits on uplands. The pits are open excavations from which several feet of soil and sand and gravel have been removed. They are now partly revegetated. Areas are irregular in shape and range from 4 to 50 acres in size.

Typically, the surface layer is very dark gray gravelly sandy loam about 8 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous gravelly sand. In places the depth to gravelly sand is more than 20 inches.

The content of organic matter and fertility are low. Permeability is rapid. Available water capacity is very low. Runoff is slow.

Most areas support native grasses. This soil is poorly suited to range. The native vegetation mainly is blue grama and needleandthread. Overused areas are dominated by threadleaf sedge, blue grama, and weeds.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Some trees and shrubs can be grown as environmental plantings and other special plantings if they are planted by hand and given special care.

This soil is poorly suited to most kinds of building site development and sanitary facilities because of the irregular slopes and the likelihood that effluent will pollute shallow ground water. Considerable land shaping is needed to develop satisfactory sites. The soil is a probable source of sand and gravel for use as road construction material.

The capability subclass is VI<sub>s</sub>; Very Shallow range site.

**Te—Tetonka silt loam.** This deep, poorly drained soil is in depressions in the uplands. It is ponded during periods of snowmelt and heavy rainfall. Areas are 5 to 60 acres in size and are oval.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsurface layer is about 6 inches thick. It is light gray silt loam in the upper part and dark gray and gray silty clay loam in the lower part. The

subsoil is about 23 inches of dark gray, very firm silty clay and silty clay loam. The underlying material to a depth of 60 inches is light gray clay loam.

Included with this soil in mapping are small areas of Hoven and Onita soils. These soils make up less than 15 percent of any one mapped area. The Hoven soils have a sodium affected subsoil. They are in positions on the landscape similar to those of the Tetonka soil. The moderately well drained Onita soils are in swales.

The content of organic matter is moderate and fertility medium in the Tetonka soil. Permeability is very slow or slow. Available water capacity is high. A seasonal high water table is within a depth of 1 foot most of the year. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native grass. This soil is fairly well suited to range. The native vegetation dominantly is sedges, prairie cordgrass, western wheatgrass, and reedgrasses. Overused areas are dominated by foxtail barley, spike sedge, and rushes. Many areas are potential sites for excavated ponds.

Unless drained, this soil is poorly suited to cultivated crops. The best suited crops are those that mature late in the growing season. The main concern of management is improving drainage. In undrained areas, crops drown and tillage is delayed for long periods in some years.

This soil is well suited to tame pasture and hay, but only the water tolerant pasture plants grow well in undrained areas. Garrison creeping foxtail and reed canarygrass are the best suited species. All climatically suited pasture plants grow well in drained areas.

Unless drained, this soil generally is unsuited to windbreaks and environmental plantings. It generally is unsuitable as a site for buildings and most sanitary facilities because of the ponding.

The capability subclass is IV<sub>w</sub>; Wet Meadow range site.

**Wo—Worthing silty clay loam.** This deep, very poorly drained, level soil is in depressions in the uplands. It is ponded during periods of snowmelt or heavy rainfall. Areas are 5 to 100 acres in size and are irregular in shape.

Typically, the surface layer is dark gray silty clay loam about 8 inches thick. The subsoil is dark gray and gray, firm and very firm silty clay about 44 inches thick. The underlying material to a depth of 60 inches is light gray, calcareous silty clay. In places the soil has a light gray subsurface layer. In some areas the surface layer is less than 8 inches thick.

Included with this soil in mapping are small areas of Hoven and Onita soils. These soils make up less than 15 percent of any one mapped area. The poorly drained Hoven soils are in positions on the landscape similar to those of the Worthing soil. They have a sodium affected subsoil. The moderately well drained Onita soils are in swales.

The content of organic matter and fertility are high in the Worthing soil. Permeability is slow. Available water capacity is moderate. A seasonal high water table is within a depth of 1 foot. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native grass. This soil is fairly well suited to range. The native vegetation dominantly is rivergrass, slough sedge, prairie cordgrass, and reedgrass. Overused areas are dominated by spike sedge and unpalatable grasses and weeds. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings and is fairly well suited to tame pasture and hay. Because the soil is frequently ponded, the number of suitable crops and pasture plants is severely limited. Garrison creeping foxtail and reed canarygrass are the best suited pasture plants.

This soil generally is unsuitable as a site for buildings and septic tank absorption fields because of the ponding.

The capability subclass is Vw; Shallow Marsh range site.

**Wp—Worthing silty clay loam, ponded.** This deep, very poorly drained, level soil is in depressions in the

uplands. It is ponded most of the year. Areas are 5 to several hundred acres in size and are circular.

Typically, the surface layer is dark gray silty clay loam about 8 inches thick. The subsoil is dark gray and gray, firm and very firm silty clay about 44 inches thick. The underlying material to a depth of 60 inches is light gray, calcareous silty clay. In some places a thin layer of partly decomposed organic material is at the surface. In other places the subsoil and underlying material have accumulations of salts. In some areas the soil has a light gray subsurface layer. In other areas the surface layer is less than 8 inches thick.

The content of organic matter and fertility are high. Permeability is slow. Available water capacity is moderate. A seasonal high water table is within a depth of 0.5 foot. As much as 3.0 feet of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native vegetation and are used as wetland wildlife habitat. The natural plant cover is a luxuriant stand of bulrushes, reedgrasses, and sedges. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. It is unsuitable as a site for buildings and sanitary facilities because of the ponding.

The capability subclass is VIIIw; no range site is assigned.



# use and management of the soils

---

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

## crops and pasture

Wayne L. Noble, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated

yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 70 percent of the acreage in Douglas County is used for cultivated crops or for tame pasture and hay. The major crops are alfalfa, corn, oats, and grain sorghum. Barley and wheat also are grown. Corn is grown for grain and silage, oats and sorghum for grain, and alfalfa mainly for hay. Alfalfa and brome grass are grown as tame pasture plants.

The potential of the soils in the county for increased crop production is good. About 45,500 acres of potentially good cropland is currently used as range, 5,570 acres as pasture, and 6,950 acres as hayland (3). Food production could be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the management needed on the cropland in the county.

*Erosion* reduces productivity and results in sedimentation. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Ethan soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Delmont soils. When erosion occurs, sediment rich in nutrients enters streams and lakes. Measures that control erosion minimize the pollution of streams and lakes by sediment and preserve water quality for fish and wildlife, recreation, and municipal use. They also reduce the amount of fertilizer needed in cropped areas and prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion.

Terraces and diversions reduce the length of slopes and the runoff rate and help to control erosion. They are

most practical on deep, well drained soils that have long, smooth slopes. Many of the soils in Douglas County are poorly suited to terraces and diversions because of short, irregular slopes or an unfavorable subsoil, which would be exposed in terrace channels.

*Soil blowing* is a slight to severe hazard on many of the soils in the county. The hazard is especially severe on the Henkin and Blendon soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. An adequate plant cover, a cover of crop residue, and a rough surface help to control soil blowing. Windbreaks of suitable trees and shrubs also are effective in controlling soil blowing.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, available in the local offices of the Soil Conservation Service.

*Soil fertility* helps to determine the yields that can be obtained from the soils. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The kinds and amounts of fertilizer needed on Ethan and other soils that have a high content of lime in the surface layer generally differ from the kinds and amounts needed on soils that do not have lime in the surface layer. On all soils additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected yield level. The Cooperative Extension Service can help in determining the kinds and amounts needed.

*Soil tilth* is an important factor in the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. In Beadle, Farmsworth, and Walke soils, tilth generally is poor. These soils dry out slowly in the spring and are difficult to till when dry. If farmed when wet, they tend to be cloddy when dry. As a result of the cloddiness, preparing a seedbed is difficult. Timely tillage, inclusion of grasses and legumes in the cropping system, and incorporation of crop residue into the soil improve tilth and increase the rate of water intake.

*Field crops* suited to the soils and climate of the survey area include close-grown crops and row crops. Oats and barley are the main close-grown crops. Corn and sorghum are the main row crops. The acreage planted to sunflowers is increasing.

The deep, well drained or moderately well drained soils in the survey area are suited to all of the crops commonly grown in the county. Examples are Bon, Clarno, Eakin, Highmore, Homme, Lane, Onita, and Prosper soils. Delmont and other droughty soils are better suited to early maturing small grain than to deeper rooted crops, such as corn and alfalfa, because the porous underlying material limits the depth to which roots can penetrate and the available water capacity. Blendon, Henkin, and other soils that are susceptible to soil blowing are better suited to close-grown crops than to other crops.

*Pasture plants* best suited to the climate and most of the soils in the survey area included alfalfa, intermediate wheatgrass, and smooth brome grass. Delmont, Enet, and other droughty soils are suited to crested wheatgrass. Because of the hazard of erosion, bunchgrasses, such as crested wheatgrass, should not be planted in areas where the slope is more than 6 percent. On the poorly drained Hoven and Tetonka soils, the choice of pasture plants is limited to water tolerant species, such as Garrison creeping foxtail and reed canarygrass.

If the pasture is overgrazed, the grasses lose vigor and die and usually are replaced by annual grasses and weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition.

### yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

### land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the

way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (9). Only class and subclass are used in this survey.

*Capability classes*, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

*Capability subclasses* are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed soil map units."

## rangeland

Wayne L. Noble, district conservationist, Soil Conservation Service, helped prepare this section.

About 25 percent of the acreage of Douglas County is rangeland (3). Most of the rangeland occurs as small tracts throughout the county, but some occurs as larger tracts of the Delmont and Talmo soils in the northwestern part of the county. More than 75 percent of farm income is derived from the sale of livestock, principally cattle. Cow-calf enterprises are dominant throughout the county. On nearly all farms a small number of cattle are fed until they are ready for market. On many farms the forage produced on rangeland is supplemented with crop aftermath. In winter the forage is supplemented with protein concentrate.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for many soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

*Total production* is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

*Dry weight* is the total annual yield per acre reduced to a common percent of air-dry moisture.

*Characteristic vegetation*—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of soil blowing and water erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The native vegetation in most parts of the county has been greatly depleted by continued excessive use. The amount of forage produced is less than half of that originally produced. The productivity of the range can be increased by applying management that is effective on specific kinds of soils and range sites.

An adequate plant cover and ground mulch help to control erosion and increase the moisture supply by reducing the runoff rate. If the range is overgrazed, the more desirable tall grasses lose vigor and are replaced by less productive short grasses. Measures that prevent overgrazing help to keep the range in good condition. Crossfencing and properly distributed watering facilities help to obtain a uniform distribution of grazing.

### **native woods and windbreaks and environmental plantings**

Wayne L. Noble, district conservationist, Soil Conservation Service, helped prepare this section.

Native trees and shrubs grow on only about 400 acres in Douglas County. They generally grow on rangeland where soil and water relationships are favorable. Most grow near the margins of natural lakes, on flood plains, and on breaks to the deeper drainageways. Nearly all of these areas are used as wildlife habitat. The soils that support trees are not classified as woodland soils.

Scattered individual plants or clumps of American elm, American plum, box elder, bur oak, common

chokecherry, common hackberry, false indigo, green ash, western snowberry, and wild rose are common on the Betts soils in drainageways. Peachleaf willow, plains cottonwood, and sandbar willow are common on the margins of the natural lakes throughout the county. Russian-olive, an introduced species, is common on nearly all of the soils in the county.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, keep snow from blowing off fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

Grazing is detrimental to windbreaks and environmental plantings because the livestock compact the soil and remove the lower branches of the trees and shrubs. The compaction retards growth. Removal of the lower branches reduces the effectiveness of the windbreak. Weeds and insects prevent maximum growth. Clean cultivation and applications of herbicide help to control the weeds. Fallowing a year before planting helps to provide a reserve supply of moisture, which is needed before seedlings can be established. On Blendon and other soils that are susceptible to soil blowing, the site should be prepared in the spring. If the site is prepared in the fall, it is exposed during the winter.

Additional information on planning windbreaks and screens and on planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

### **wildlife habitat**

John B. Farley, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and

abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges and management areas, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

*Grain and seed crops* are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are barley, corn, oats, millet, sunflower, and wheat.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are alfalfa, intermediate wheatgrass, smooth brome grass, tall wheatgrass, and yellow sweetclover.

*Wild herbaceous plants* are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild

herbaceous plants are beggarweed, big and little bluestem, blue grama, goldenrod, switchgrass, and wheatgrass.

*Hardwood trees* are planted trees and shrubs that produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are American elm, apple, box elder, bur oak, green ash, hackberry, and plains cottonwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, and Russian-olive.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are cattail, inland saltgrass, prairie cordgrass, reeds, rushes, sedges, smartweed, and wild millet.

*Shallow water areas* have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are duck fields, level ditches, marshes, ponds, shallow dugouts, and waterfowl feeding areas.

The habitat for various kinds of wildlife is described in the following paragraphs.

*Habitat for openland wildlife* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and trees. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous and woody plants. The wildlife attracted to these areas include cottontail, gray partridge, meadowlark, mourning dove, red fox, ring-necked pheasant, sparrows, and whitetail jackrabbit.

*Habitat for wetland wildlife* consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, mink, muskrat, and shore birds.

*Habitat for rangeland wildlife* consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include lark bunting, meadowlark, whitetail deer, and whitetail jackrabbit.

## engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

*Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.*

*The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.*

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

### **building site development**

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and

without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

*Shallow excavations* are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

*Dwellings and small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

*Local roads and streets* have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

### **sanitary facilities**

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons,

and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

*Septic tank absorption fields* are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

*Sewage lagoons* (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and

observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

*Sanitary landfills* are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

*Daily cover for landfill* is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

## construction materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

*Roadfill* is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

*Sand and gravel* are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

*Topsoil* is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

## water management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not

favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

*Embankments, dikes, and levees* are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

*Drainage* is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to

bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

*Irrigation* is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

*Grassed waterways* are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.



# soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

## engineering index properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

*Depth* to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 or 20 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

*Classification* of the soils is determined according to the Unified soil classification system (2) and the system

adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

*Rock fragments* larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

*Percentage (of soil particles) passing designated sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

*Liquid limit and plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

## physical and chemical properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Permeability* refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

*Available water capacity* refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

*Soil reaction* is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

*Salinity* is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

*Shrink-swell potential* is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

*Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K in the survey area range from 0.10 to 0.43. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor T* is an estimate of the maximum average annual rate of soil erosion by wind and water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
- 4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.
4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition.

In table 14, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

## soil and water features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

*Flooding*, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*High water table* (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

*Potential frost action* is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent

collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

*Risk of corrosion* pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as

soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

# classification of the soils

---

The system of soil classification used by the National Cooperative Soil Survey has six categories (10). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 16, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

**ORDER.** Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

**SUBORDER.** Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

**GREAT GROUP.** Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

**SUBGROUP.** Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplustolls.

**FAMILY.** Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties

and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplustolls.

**SERIES.** The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

## soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (8). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (10). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

## Arlo series

The Arlo series consists of poorly drained and very poorly drained soils formed in loamy alluvial sediments that are moderately deep over gravelly sand. Permeability is moderate in the solum and rapid in the underlying material. These soils are in upland swales and depressions. Slopes range from 0 to 2 percent.

Arlo soils are similar to Dimo soils and are near Delmont, Enet, and Tetonka soils. The somewhat excessively drained Delmont soils are higher on the landscape than the Arlo soils. They are 14 to 20 inches deep over gravelly sand. Dimo soils do not have a calcic

horizon. The well drained Enet soils are in an intermediate position on the landscape between the Delmont and Tetonka soils. The poorly drained Tetonka soils are in depressions.

Typical pedon of Arlo loam, 100 feet south and 199 feet west of the northeast corner of sec. 25, T. 98 N., R. 63 W.

A11ca—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium granular structure; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

A12ca—8 to 19 inches; gray (10YR 5/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; strong effervescence; mildly alkaline; clear wavy boundary.

A13ca—19 to 23 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; strong effervescence; mildly alkaline; clear wavy boundary.

B2ca—23 to 36 inches; gray (10YR 6/1) loam, very dark grayish brown (10YR 3/2) moist; few fine faint dark yellowish brown (10YR 4/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; violent effervescence; mildly alkaline; clear wavy boundary.

IIC2—36 to 60 inches; multicolored gravelly sand; single grain; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 0 to 6 inches. The thickness of the mollic epipedon ranges from 7 to 24 inches.

The A horizon is neutral in hue or has hue of 10YR or 5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1. It is loam or silt loam. The B2 horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 to 3. Some pedons have a B3 horizon. The B3 and IIC horizons have hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4. The B2 and B3 horizons have few or common, faint to distinct mottles.

The Arlo soil occurring as Arlo loam, wet, contains more clay in the subsoil and is deeper to gravelly sand than is defined as the range for the series. These differences, however, do not affect the use or behavior of the soil.

## Beadle series

The Beadle series consists of deep, well drained soils formed in clay loam glacial till on uplands. Permeability is slow. Slopes range from 2 to 6 percent.

Beadle soils commonly are near Eakin, Ethan, and Lane soils. Eakin soils contain less clay, more silt, and less sand in the subsoil than the Beadle soils. Ethan soils are more shallow to free carbonates than the

Beadle soils. Eakin and Ethan soils are in positions on the landscape similar to those of the Beadle soils. Lane soils have a mollic epipedon that is more than 20 inches thick. They are lower on the landscape than the Beadle soils.

Typical pedon of Beadle clay loam, 2 to 6 percent slopes, 100 feet south and 1,320 feet east of the northwest corner of sec. 11, T. 100 N., R. 66 W.

Ap—0 to 5 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak medium granular structure; very hard, friable; slightly acid; abrupt smooth boundary.

A12—5 to 7 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak medium granular; very hard, friable; neutral; clear wavy boundary.

B21t—7 to 12 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; neutral; clear wavy boundary.

B22t—12 to 15 inches; very dark grayish brown (2.5Y 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; shiny films on faces of peds; neutral; clear wavy boundary.

B3ca—15 to 30 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky and plastic; common medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C1—30 to 39 inches; pale olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; massive; hard, friable; strong effervescence; mildly alkaline; clear wavy boundary.

C2—39 to 60 inches; olive (5Y 5/3) clay loam, olive (5Y 4/3) moist; few fine faint light yellowish brown (10YR 6/4) and very pale brown (10YR 8/4) mottles; massive; very hard, friable; strong effervescence; common fine and medium accumulations of gypsum; mildly alkaline.

The thickness of the mollic epipedon ranges from 8 to 20 inches. The thickness of the solum ranges from 16 to 37 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B2 horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 to 3. It is clay loam or clay. It is neutral or mildly alkaline. The B3ca and C horizons have value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. Gypsum crystals are in most pedons.

## Betts series

The Betts series consists of deep, well drained soils formed in calcareous loamy glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 15 to 40 percent.

Betts soils are similar to Ethan soils and commonly are near Clarno, Davis, and Ethan soils. All of the nearby soils have a mollic epipedon. They generally are on the less sloping parts of the landscape.

Typical pedon of Betts loam, in an area of Betts-Ethan loams, 15 to 40 percent slopes, 660 feet west and 2,355 feet south of the northeast corner of sec. 33, T. 100 N., R. 63 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; abrupt smooth boundary.

B2—3 to 9 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; violent effervescence; mildly alkaline; gradual wavy boundary.

C1ca—9 to 27 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C2—27 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable; violent effervescence; mildly alkaline.

The solum is less than 10 inches thick. The depth to free carbonates is 0 to 3 inches. The content of calcium carbonate is more than 15 percent in the C1ca horizon.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. The B2 horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is clay loam or loam and is mildly alkaline or moderately alkaline. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is clay loam, loam, or sandy loam. It has few to many accumulations of carbonate. Gypsum crystals are below a depth of 40 inches in some pedons.

## Blendon series

The Blendon series consists of deep, well drained soils formed in loamy and sandy glacial melt water deposits on uplands and terraces. Permeability is moderately rapid. Slopes range from 0 to 6 percent.

Blendon soils are similar to Henkin soils and commonly are near Enet and Tetonka soils. Enet and Henkin soils are on the higher parts of the landscape.

Enet soils contain more clay in the subsoil than the Blendon soils and are underlain by gravelly sand. Henkin soils have a mollic epipedon that is less than 20 inches thick and are more shallow to free carbonates than the Blendon soils. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Blendon fine sandy loam, in an area of Henkin-Blendon fine sandy loams, 0 to 2 percent slopes, 782 feet south and 405 feet east of the northwest corner of sec. 14, T. 100 N., R. 65 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; slightly acid; gradual smooth boundary.

A12—7 to 13 inches; very dark grayish brown (10YR 3/2) fine sandy loam, black (10YR 2/1) moist; very weak fine subangular blocky structure parting to weak fine granular; soft, very friable; medium acid; gradual wavy boundary.

B2—13 to 29 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; soft, very friable; slightly acid; gradual wavy boundary.

B3—29 to 34 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; gradual wavy boundary.

C1—34 to 44 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; gradual wavy boundary.

C2—44 to 60 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; massive; soft, very friable; neutral.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The thickness of the solum ranges from 24 to 50 inches. The depth to free carbonates ranges from 50 to more than 60 inches.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1 or 2. It typically is fine sandy loam, but loam is within the range. The B horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is fine sandy loam, sandy loam, or loam. It is slightly acid or neutral. Some pedons do not have a B3 horizon. The C horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 4. It typically is loamy fine sand, but loamy sand, sandy loam, and fine sandy loam are within the range. Fine and medium gravel is below a depth of 40 inches in some pedons.

## Bon series

The Bon series consists of deep, well drained and moderately well drained soils formed in calcareous

alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Bon soils are similar to Davis soils and commonly are adjacent to Dimo, Farmsworth, Lane, and Napa soils. All of the adjacent soils are in positions on the landscape similar to those of the Bon soils. Davis soils are on foot slopes. They are leached of carbonates to a depth of at least 20 inches. Dimo soils have gravelly sand at a depth of 20 to 40 inches. Farmsworth and Napa soils have a natric horizon. Lane soils contain more clay in the subsoil than the Bon soils.

Typical pedon of Bon loam, 257 feet east and 990 feet north of the southwest corner of sec. 36, T. 98 N., R. 62 W.

- A11—0 to 5 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak medium and fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.
- A12—5 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.
- A13—10 to 16 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.
- A14—16 to 22 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; slightly hard, very friable; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.
- C1—22 to 34 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline; gradual irregular boundary.
- C2—34 to 60 inches; pale olive (5Y 6/3) loam stratified with thin layers of fine and very fine sand, olive (5Y 4/3) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to free carbonates is 0 to 16 inches.

The A horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 or 2. It dominantly is loam, but silt loam is within the range. The C horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 to 3. It generally is stratified with thin layers of fine sand, very fine sand, or silt loam.

### Clarno series

The Clarno series consists of deep, well drained soils formed in glacial till on uplands. Permeability is moderate

in the solum and moderately slow in the underlying material. Slopes range from 0 to 15 percent.

Clarno soils are similar to Ethan soils and commonly are adjacent to Davis, Prosper, Stickney, and Tetonka soils. Davis and Prosper soils have a mollic epipedon that is more than 20 inches thick. Ethan soils are more shallow to free carbonates than the Clarno soils. Stickney soils have a natric horizon. Tetonka soils are poorly drained and are in depressions. Davis, Prosper, and Stickney soils are in an intermediate position on the landscape between the Clarno and Tetonka soils. Ethan soils are higher on the landscape than the Clarno soils.

Typical pedon of Clarno loam, in an area of Clarno-Ethan-Prosper loams, 1 to 6 percent slopes, 103 feet south and 580 feet west of the northeast corner of sec. 9, T. 100 N., R. 63 W.

- Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.
- A12—6 to 9 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, very friable; slightly acid; clear wavy boundary.
- B21—9 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; gradual wavy boundary.
- B22—13 to 17 inches; dark grayish brown (2.5Y 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear wavy boundary.
- B3ca—17 to 30 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.
- C1ca—30 to 40 inches; pale yellow (5Y 7/3) loam, olive (5Y 5/3) moist; massive; hard, very friable; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.
- C2—40 to 60 inches; pale olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; common fine distinct light gray (10YR 7/1) and olive yellow (2.5Y 6/8) mottles; massive; slightly hard, friable; few fine accumulations of gypsum; strong effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. The thickness of the solum ranges from 20 to 42 inches. The depth to free carbonates ranges from 12 to 26 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B2 horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. It is loam or clay loam. It is neutral or mildly alkaline. The B3 and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. They are loam or clay loam. The mottles in the C horizon are inherited from the parent material. The accumulations of carbonate in the B3 horizon and the upper part of the C horizon range from few to many. Some pedons do not have gypsum crystals in the lower part of the C horizon.

### Davis series

The Davis series consists of deep, well drained soils formed in loamy and silty colluvium on foot slopes and fans. Permeability is moderate. Slopes range from 2 to 6 percent.

Davis soils are similar to Bon and Prosper soils and are near Betts, Clarno, and Ethan soils. Betts soils do not have a mollic epipedon. They are on the higher parts of the landscape. Bon soils are more shallow to free carbonates than the Davis soils. They are along drainageways on the lower parts of the landscape. Clarno and Ethan soils have a mollic epipedon that is less than 20 inches thick. They are higher on the landscape than the Davis soils. Prosper soils have an argillic horizon. They are in swales.

Typical pedon of Davis silt loam, 2 to 6 percent slopes, 650 feet north and 100 feet east of the southwest corner of sec. 21, T. 100 N., R. 63 W.

- A11—0 to 7 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, very friable; slightly acid; gradual wavy boundary.
- A12—7 to 17 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure; hard, very friable; neutral; gradual wavy boundary.
- B21—17 to 24 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; gradual wavy boundary.
- B22—24 to 36 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, friable; mildly alkaline; clear wavy boundary.
- B3—36 to 55 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.
- Cca—55 to 60 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; very

hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The mollic epipedon is 20 or more inches thick. The thickness of the solum ranges from 30 to 60 inches. The depth to free carbonates ranges from 20 to 45 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B horizon has value of 3 to 5 (2 to 4 moist).

### DeGrey series

The DeGrey series consists of deep, moderately well drained soils formed in silty and clayey material over clay loam glacial till on uplands. Permeability is slow. Slopes range from 0 to 4 percent.

DeGrey soils are similar to Farmsworth and Walke soils and commonly are near Eakin, Highmore, Hoven, Onita, Tetonka, and Walke soils. Eakin and Highmore soils do not have a natric horizon. They are on the higher parts of the landscape. The somewhat poorly drained Farmsworth soils are on stream terraces. Hoven and Tetonka soils are poorly drained and are in depressions. Onita soils have a mollic epipedon that is thicker than that of the DeGrey soils and do not have a natric horizon. They are in swales. Walke soils do not have columnar structure in the B2t horizon. They are in positions on the landscape similar to those of the DeGrey soils.

Typical pedon of DeGrey silt loam, in an area of DeGrey-Walke silt loams, 0 to 4 percent slopes, 62 feet south and 84 feet west of the northeast corner of sec. 18, T. 100 N., R. 65 W.

- A1—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; slightly hard, friable; neutral; clear smooth boundary.
- A2—6 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure parting to moderate medium and fine granular; slightly hard, friable; neutral; clear wavy boundary.
- B21t—8 to 12 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to strong medium and fine blocky; extremely hard, very firm, sticky and plastic; shiny films on faces of peds; grayish brown (10YR 5/2) coatings on the tops of columns; neutral; clear wavy boundary.
- B22t—12 to 20 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong medium and fine blocky; extremely hard, very firm, sticky and plastic; shiny films on faces of peds; moderately alkaline; clear wavy boundary.
- B3ca—20 to 25 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate

medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; few fine crystals of gypsum; slight effervescence; moderately alkaline; clear wavy boundary.

C1ca—25 to 40 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak fine subangular blocky structure; very hard, firm; few fine accumulations of carbonate; few fine crystals of gypsum; violent effervescence; moderately alkaline; clear wavy boundary.

IIC2—40 to 50 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine faint light olive brown (2.5Y 5/6) and light gray (2.5Y 7/2) mottles; massive; hard, firm; few fine crystals of gypsum; violent effervescence; moderately alkaline; clear wavy boundary.

IIC3—50 to 60 inches; olive (5Y 5/3) clay loam, olive (5Y 4/3) moist; common fine faint light olive brown (2.5Y 5/6) and light gray (2.5Y 7/2) mottles; massive; hard, firm; few fine crystals of gypsum; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 20 inches. The thickness of the solum ranges from 15 to 34 inches. The depth to free carbonates ranges from 10 to 24 inches. The thickness of the silty mantle over loamy glacial till ranges from 20 to more than 40 inches.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The A2 horizon has value of 5 to 7 (3 or 4 moist) and chroma of 1 to 3. In most plowed fields it is mixed with the A1 horizon. The B2t horizon has value of 4 or 5 (3 or 4 moist) and chroma of 1 or 2. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. The IIC horizon is clay loam or loam. Its mottles are inherited from the parent material. The accumulations of carbonate range from few to many. Gypsum crystals or other salts are below a depth of 20 inches in most pedons.

## Delmont series

The Delmont series consists of somewhat excessively drained soils that are shallow over gravelly sand. These soils formed in loamy glacial outwash or alluvial sediments over sand and gravel. They are on terraces and uplands. Permeability is moderate or moderately rapid in the solum and rapid in the underlying material. Slopes range from 0 to 9 percent.

Delmont soils are similar to Enet and Talmo soils and commonly are adjacent to Arlo, Blendon, Clarno, and Henkin soils. Arlo soils are poorly drained and very poorly drained and are on the lower parts of the landscape. Blendon soils are not underlain by gravelly sand. They are on the lower parts of the landscape. Clarno soils are not underlain by gravelly sand. Enet soils are deeper to gravelly sand than the Delmont soils.

Henkin soils contain more sand and less clay in the subsoil than the Delmont soils. Talmo soils are shallower to gravelly sand than the Delmont soils. Clarno, Enet, Henkin, and Talmo soils are in positions on the landscape similar to those of the Delmont soils. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Delmont loam, in an area of Delmont-Talmo loams, 2 to 9 percent slopes, 835 feet east and 411 feet south of the northwest corner of sec. 11, T. 100 N., R. 64 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium granular structure; soft, very friable; neutral; gradual wavy boundary.

B21—7 to 10 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; neutral; gradual wavy boundary.

B22—10 to 17 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; mildly alkaline; clear smooth boundary.

IIC1ca—17 to 50 inches; multicolored gravelly sand; single grain; loose; sand and gravel coated with carbonate, mainly on the undersides; violent effervescence; mildly alkaline; gradual wavy boundary.

IIC2—50 to 60 inches; multicolored gravelly sand; single grain; loose; sand and gravel partly coated with carbonate; violent effervescence; mildly alkaline.

The thickness of the solum, the depth to free carbonates, and the depth to gravelly sand range from 14 to 20 inches. The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 to 3. The B2 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2.

## Dimo series

The Dimo series consists of somewhat poorly drained soils formed in loamy alluvium that is moderately deep over sand and gravel. Permeability is moderate in the solum and rapid in the underlying material. These soils are in drainageways on glacial melt water plains. Slopes range from 0 to 2 percent.

Dimo soils are similar to Arlo soils and commonly are near Bon, Clarno, Delmont, and Enet soils. Arlo soils have a calcic horizon. Bon soils are not underlain by gravelly sand. They are in positions on the landscape similar to those of the Dimo soils. Clarno soils are well drained. They are not underlain by gravelly sand. Delmont soils are somewhat excessively drained. They have gravelly sand within a depth of 20 inches. Enet soils are well drained and do not have a seasonal high water table. Clarno, Delmont, and Enet soils are higher on the landscape than the Dimo soils.

Typical pedon of Dimo loam, 74 feet west and 784 feet south of the northeast corner of sec. 14, T. 100 N., R. 64 W.

- A1—0 to 7 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; soft, very friable; neutral; clear wavy boundary.
- B21—7 to 18 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.
- B22—18 to 24 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; common fine faint dark reddish brown (5YR 3/4), very dark gray (5Y 3/1), and yellowish red (5YR 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; hard, very friable; neutral; clear wavy boundary.
- B3—24 to 28 inches; dark grayish brown (2.5Y 4/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; many fine distinct very dark gray (5YR 3/1), dark reddish brown (5YR 3/2), and yellowish red (5YR 4/6 and 5/8) mottles; weak coarse subangular blocky structure parting to weak medium and fine subangular blocky; hard, very friable; few fine accumulations of iron and manganese oxides; slight effervescence; mildly alkaline; gradual wavy boundary.
- IIC1ca—28 to 46 inches; multicolored gravelly sand; single grain; loose; violent effervescence; moderately alkaline; clear wavy boundary.
- IIC2—46 to 60 inches; multicolored gravelly sand; single grain; loose; strong effervescence; moderately alkaline.

The mollic epipedon and the solum range from 20 to 40 inches in thickness. The depth to free carbonates ranges from 15 to 40 inches.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1 or 2. The B2 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is loam or clay loam. It is neutral or mildly alkaline. The IIC horizon has value of 5 to 8 (4 to 6 moist) and chroma of 1 to 3.

## Eakin series

The Eakin series consists of deep, well drained soils formed in silty material over glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 9 percent.

Eakin soils are similar to Highmore and Homme soils and commonly are near DeGrey, Ethan, Onita, and Walke soils. DeGrey and Walke soils have a natric horizon. They are slightly lower on the landscape than the Eakin soils. Ethan soils contain more sand and less

silt in the subsoil than the Eakin soils and are shallower to free carbonates. They are on the higher parts of the landscape. Highmore soils have glacial till below a depth of 40 inches. Homme soils do not have an argillic horizon. Onita soils are moderately well drained and are in swales. They have a mollic epipedon that is more than 20 inches thick.

Typical pedon of Eakin silt loam, in an area of Eakin-Ethan complex, 3 to 6 percent slopes, 83 feet south and 289 feet west of the northeast corner of sec. 36, T. 99 N., R. 65 W.

- Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, very friable; slightly acid; abrupt smooth boundary.
- B21t—7 to 13 inches; brown (10YR 5/3) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very friable, sticky and plastic; neutral; clear smooth boundary.
- B22t—13 to 18 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.
- B3ca—18 to 33 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.
- IIC1—33 to 44 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; few fine faint yellowish red (5YR 5/6) mottles; massive; very hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.
- IIC2—44 to 60 inches; light gray (2.5Y 7/2) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; extremely hard, friable, slightly sticky and plastic; common medium distinct nests of gypsum crystals; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 19 to 36 inches. The depth to free carbonates ranges from 10 to 18 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to glacial till ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The B2t horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. The B3ca horizon has few to many accumulations of carbonate. The IIC horizon has value of 5 to 7 (4 or 5 moist) and chroma of 1 to 4. The mottles are inherited from the parent material. Some pedons do not have gypsum crystals in the lower part of the IIC horizon.

## Enet series

The Enet series consists of well drained soils that are moderately deep over sand and gravel. These soils formed in glacial outwash or alluvial sediments on uplands and stream terraces. Permeability is moderate in the solum and rapid in the underlying material. Slopes range from 0 to 6 percent.

Enet soils are similar to Delmont soils and commonly are near Blendon, Delmont, Dimo, Henkin, Tetonka, and Worthing soils. Blendon and Henkin soils contain less clay in the subsoil than the Enet soils. Delmont soils are 14 to 20 inches deep to gravelly sand. Dimo soils have a seasonal high water table at a depth of 2 to 6 feet. They are along drainageways. Blendon, Delmont, and Henkin soils are in positions on the landscape similar to those of the Enet soils. The poorly drained Tetonka and very poorly drained Worthing soils are in depressions.

Typical pedon of Enet loam, in an area of Enet-Delmont loams, 0 to 2 percent slopes, 200 feet south and 2,604 feet west of the northeast corner of sec. 1, T. 97 N., R. 63 W.

- A1—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; medium acid; clear wavy boundary.
- B21—6 to 14 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.
- B22—14 to 24 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.
- B3—24 to 29 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.
- IIC1—29 to 60 inches; multicolored gravelly sand; single grain; loose; strong effervescence; moderately alkaline.

The mollic epipedon and the solum range from 20 to 40 inches in thickness. The depth to free carbonates ranges from 15 to 40 inches. The A and B2 horizons have value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. Some pedons do not have a B3 horizon.

## Ethan series

The Ethan series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the solum and moderately slow in the underlying material. Slopes range from 2 to 40 percent.

Ethan soils are similar to Betts and Clarno soils and commonly are near Betts, Clarno, Eakin, and Homme soils. Betts soils do not have a mollic epipedon. They are on the higher parts of the landscape. Clarno soils are leached of free carbonates to a greater depth than the Ethan soils. Homme soils contain more clay in the subsoil than the Ethan soils. Eakin soils contain more silt in the subsoil than the Ethan soils. Clarno, Homme, and Eakin soils are on the lower parts of the landscape.

Typical pedon of Ethan loam, in an area of Eakin-Ethan complex, 3 to 6 percent slopes, 100 feet north and 2,120 feet east of the southwest corner of sec. 21, T. 100 N., R. 66 W.

- Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.
- B2—5 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.
- B3ca—8 to 27 inches; very pale brown (10YR 7/3) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; few fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.
- C1ca—27 to 37 inches; pale olive (5Y 6/3) clay loam, olive brown (2.5Y 4/4) moist; common fine distinct gray (10YR 5/1) and dark yellowish brown (10YR 4/6) mottles; massive; slightly hard, friable; few fine accumulations of carbonate and gypsum crystals; violent effervescence; moderately alkaline; gradual wavy boundary.
- C2—37 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive (5Y 5/3) moist; common fine distinct gray (10YR 5/1) and dark yellowish brown (10YR 4/6) mottles; massive; slightly hard, friable; common fine accumulations of carbonate; violent effervescence; mildly alkaline.

The mollic epipedon is 7 to 10 inches thick. The thickness of the solum ranges from 20 to 30 inches. The depth to free carbonates is 0 to 9 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It typically is loam, but clay loam is within the range. The B2 horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. The B horizon is loam or clay loam. It is neutral or mildly alkaline. Some pedons do not have a B horizon. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 to 4. It is clay loam, loam, silt loam, or fine sandy loam. The mottles in this horizon are inherited from the parent material. The accumulations of carbonate in the B3 and C horizons range from few to many. In some pedons the C horizon does not have accumulations of gypsum.

## Farmsworth series

The Farmsworth series consists of deep, somewhat poorly drained soils formed in alluvial sediments on flood plains. Permeability is slow or very slow. Slopes are 0 to 1 percent.

Farmsworth soils are similar to DeGrey, Stickney, and Walke soils and commonly are near Bon, Lane, and Napa soils. Bon soils are well drained and moderately well drained. They contain less clay in the subsoil than the Farmsworth soils and do not have a natric horizon. The moderately well drained DeGrey and Stickney and well drained Walke soils are on uplands. Lane soils do not have a natric horizon. Napa soils are poorly drained. Bon, Lane, and Napa soils are in positions on the landscape similar to those of the Farmsworth soils.

Typical pedon of Farmsworth silt loam, 127 feet north and 1,585 feet west of the southeast corner of sec. 10, T. 98 N., R. 63 W.

- A1—0 to 3 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, friable; neutral; clear smooth boundary.
- A2—3 to 5 inches; light gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; weak thin platy structure; soft, very friable; slightly acid; clear wavy boundary.
- B21t—5 to 10 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium columnar structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; thin gray (10YR 6/1) coatings on the tops of columns; neutral; gradual wavy boundary.
- B22t—10 to 19 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; neutral; clear wavy boundary.
- B23t—19 to 24 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; slight effervescence; mildly alkaline; clear wavy boundary.
- B3cacs—24 to 35 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine faint yellow (2.5Y 7/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very firm, sticky and plastic; few fine crystals of gypsum and salt; strong effervescence; moderately alkaline; gradual wavy boundary.
- Ccacs—35 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; many fine and medium distinct dark yellowish brown (10YR 4/6) mottles; massive; hard, firm; few fine crystals of gypsum; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 36 inches. The thickness of the solum ranges from 20 to 46 inches. The depth to free carbonates ranges from 10 to 30 inches.

The A1 horizon has value of 3 or 4 (2 or 3 moist). It ranges from medium acid to neutral. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. The B2t horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 to 4 moist). It is silty clay or clay. It is neutral or mildly alkaline. The B3 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 3. It ranges from mildly alkaline to strongly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 4. It is clay, silty clay, or clay loam. It ranges from mildly alkaline to strongly alkaline.

## Henkin series

The Henkin series consists of deep, well drained soils formed in sandy and loamy glacial melt water deposits on uplands and terraces. Permeability is moderately rapid. Slopes range from 0 to 6 percent.

Henkin soils are similar to Blendon soils and commonly are adjacent to Delmont and Enet soils. Blendon soils have a mollic epipedon that is more than 20 inches thick. They are on the lower parts of the landscape. Delmont and Enet soils contain more clay in the subsoil than the Henkin soils and are underlain by gravelly sand. They are in positions on the landscape similar to those of the Henkin soils.

Typical pedon of Henkin fine sandy loam, in an area of Henkin-Blendon fine sandy loams, 2 to 6 percent slopes, 419 feet west and 2,580 feet north of the southeast corner of sec. 9, T. 100 N., R. 66 W.

- Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.
- B21—8 to 12 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.
- B22—12 to 18 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak medium and fine granular; hard, very friable; neutral; clear wavy boundary.
- B3ca—18 to 26 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak medium and fine granular; slightly hard, very friable; violent effervescence; mildly alkaline; clear wavy boundary.
- C1—26 to 50 inches; pale brown (10YR 6/3) fine and very fine sand, brown (10YR 4/3) moist; single grain; loose; violent effervescence; mildly alkaline; gradual wavy boundary.

C2—50 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grain; loose; violent effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 7 to 20 inches. The thickness of the solum ranges from 21 to 48 inches. The depth to free carbonates ranges from 18 to 40 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B2 horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is fine sandy loam, fine sand, very fine sand, or loamy fine sand. Clay loam or loam glacial till is below a depth of 40 inches in some pedons.

### Highmore series

The Highmore series consists of deep, well drained soils formed in silty glacial drift over loamy glacial till on uplands. Permeability is moderate in the upper part of these soils and moderately slow in the lower part of the underlying material. Slopes range from 0 to 6 percent.

Highmore soils are similar to Eakin and Homme soils and commonly are near DeGrey, Onita, Tetonka, and Walke soils. DeGrey and Walke soils have a natric horizon. They are slightly lower on the landscape than the Highmore soils. Eakin soils are 20 to 40 inches deep to glacial till. Homme soils do not have an argillic horizon. Onita soils have a mollic epipedon that is more than 20 inches thick. They are in swales and drainageways. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Highmore silt loam, in an area of Highmore-Walke silt loams, 0 to 3 percent slopes, 138 feet south and 1,149 feet east of the northwest corner of sec. 12, T. 99 N., R. 65 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

B21t—9 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; shiny films on faces of peds; neutral; clear wavy boundary.

B22t—13 to 19 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; shiny films on faces of peds; neutral; clear wavy boundary.

B3ca—19 to 33 inches; light yellowish brown (2.5Y 6/3) silty clay loam, olive brown (2.5Y 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; common fine

and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—33 to 52 inches; pale yellow (2.5Y 7/4) silt loam, olive brown (2.5Y 4/4) moist; few fine faint olive yellow (2.5Y 6/6) and light gray (2.5Y 7/2) mottles; massive; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

IIC2ca—52 to 60 inches; pale yellow (2.5Y 7/4) loam, olive brown (2.5Y 4/4) moist; few medium distinct yellowish red (5YR 5/8) and few fine faint light gray (2.5Y 7/1) mottles; massive; hard, friable; few fine accumulations of carbonate; violent effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 9 to 20 inches. The thickness of the solum ranges from 17 to 36 inches. The depth to free carbonates ranges from 12 to 26 inches. The depth to loamy glacial till ranges from 40 to more than 60 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. The B2t horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. It is neutral or mildly alkaline. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It is silt loam or silty clay loam. The mottles in this horizon are inherited from the parent material. The accumulations of carbonate in the B3ca horizon and the upper part of the C horizon range from few to many. The IIC horizon is loam or clay loam and has colors similar to those of the overlying C horizon.

### Homme series

The Homme series consists of deep, well drained soils formed in silty glacial drift over loamy glacial till on uplands. Permeability is moderately slow. Slopes range from 0 to 6 percent.

Homme soils are similar to Eakin, Highmore, and Onita soils and commonly are near Clarno, Eakin, Ethan, Lane, Onita, and Walke soils. Clarno and Ethan soils contain less clay in the subsoil than the Homme soils. They are in positions on the landscape similar to those of the Homme soils. Highmore and Eakin soils have an argillic horizon. Lane and Onita soils have a mollic epipedon that is more than 20 inches thick. Lane soils are on terraces, and Onita soils are in swales. Walke soils have a natric horizon. They are in slight depressions.

Typical pedon of Homme silty clay loam, in an area of Homme-Onita silty clay loams, 0 to 2 percent slopes, 154 feet north and 2,543 feet east of the southwest corner of sec. 14, T. 97 N., R. 62 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky and weak medium granular structure; hard, friable; neutral; abrupt smooth boundary.

B21—10 to 18 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable; neutral; gradual wavy boundary.

B22—18 to 28 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable; neutral; clear wavy boundary.

B3ca—28 to 37 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; very hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—37 to 46 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to moderate fine subangular blocky; very hard, friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual irregular boundary.

IIC2—46 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to free carbonates ranges from 18 to 30 inches. The depth to loamy glacial till ranges from 25 to 50 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B2 horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 to 3. The B3ca horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. The IIC horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam or clay loam.

## Hoven series

The Hoven series consists of deep, poorly drained soils formed in local alluvium in depressions on uplands. Permeability is very slow. Slopes are less than 2 percent.

Hoven soils are similar to Napa soils and commonly are near DeGrey, Highmore, Onita, Tetonka, and Walke soils. The moderately well drained DeGrey and well drained Walke soils are on the higher parts of the landscape. Highmore, Onita, and Tetonka soils do not have a natric horizon. The well drained Highmore soils are on the higher parts of the landscape. The moderately well drained Onita soils are in swales. Tetonka soils are in positions on the landscape similar to those of the Hoven soils. Napa soils are more shallow to visible salts than the Hoven soils. They are on stream terraces.

Typical pedon of Hoven silt loam, 51 feet west and 986 feet south of the northeast corner of sec. 14, T. 99 N., R. 65 W.

A2—0 to 5 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; common fine faint brownish yellow (10YR 6/8) mottles; weak thin platy structure; slightly hard, very friable; medium acid; clear wavy boundary.

B21t—5 to 8 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; strong medium columnar structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; thin gray (10YR 6/1) coatings on the tops of columns; slightly acid; gradual wavy boundary.

B22t—8 to 22 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; slightly acid; gradual wavy boundary.

B3cs—22 to 32 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm, sticky and plastic; common fine accumulations of gypsum; mildly alkaline; gradual wavy boundary.

C1—32 to 48 inches; gray (5Y 5/1) and brown (10YR 5/3) clay loam, very dark gray (10YR 3/1) and brown (10YR 4/3) moist; dark gray (10YR 4/1) tongues on faces of peds; many fine and medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very hard, friable; few fine accumulations of gypsum; strong effervescence; mildly alkaline; clear wavy boundary.

C2—48 to 60 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; many fine prominent yellowish brown (10YR 5/8) mottles; massive; hard, friable; few medium nests of gypsum; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 11 to 42 inches. The thickness of the solum ranges from 15 to 40 inches. The depth to free carbonates ranges from 7 to 27 inches.

Some pedons have an A1 horizon, which is 1 to 4 inches thick. The A2 horizon has value of 5 to 7 (2 to 4 moist) and chroma of 1 or 2. In most pedons it has few or common, faint or distinct mottles. The B2t horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is silty clay or clay. The C horizon has value of 4 to 7 (3 to 5 moist) and chroma of 1 to 3. It has few to many mottles. It is clay, silty clay, clay loam, or silt loam.

## Lane series

The Lane series consists of deep, well drained soils formed in alluvial sediments on stream terraces and foot

slopes. Permeability is moderately slow or slow. Slopes range from 0 to 2 percent.

Lane soils are similar to Onita soils and commonly are near Beadle, Clarno, Delmont, Enet, Highmore, and Onita soils. Except for the Onita soils, all of the nearby soils are on the higher parts of the landscape. Beadle, Clarno, and Highmore soils have a mollic epipedon that is less than 20 inches thick. Delmont and Enet soils are underlain by gravelly sand. Onita soils are leached of carbonates to a greater depth than the Lane soils. They are in positions on the landscape similar to those of the Lane soils.

Typical pedon of Lane silty clay loam, 2,630 feet north and 300 feet west of the southeast corner of sec. 1, T. 97 N., R. 63 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate medium granular structure; hard, friable; neutral; clear smooth boundary.

B21t—10 to 21 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B22t—21 to 26 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

B3ca—26 to 44 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; strong effervescence; common fine and medium accumulations of carbonate; mildly alkaline; gradual wavy boundary.

C1ca—44 to 55 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; few fine faint yellowish brown (10YR 5/8) mottles; hard, firm; strong effervescence; common fine and medium accumulations of carbonate; moderately alkaline; gradual wavy boundary.

C2—55 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/8) mottles; massive; hard, friable; strong effervescence; few fine accumulations of carbonate; mildly alkaline.

The thickness of the mollic epipedon ranges from 20 to 36 inches. The thickness of the solum ranges from 30 to 45 inches. The depth to free carbonates ranges from 8 to 22 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is silty clay loam or clay loam. The B2t horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is clay loam, silty clay, or clay. It is

neutral or mildly alkaline. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It is silty clay loam, silty clay, or clay loam. Few or common nests of gypsum are in some pedons.

## Macken series

The Macken series consists of deep, poorly drained soils formed in local alluvium in large depressions on uplands. Permeability is slow. Slopes are 0 to 1 percent.

Macken soils commonly are near Beadle, DeGrey, Eakin, Hoven, Lane, and Walke soils. Except for the Hoven soils, all of the nearby soils are on the higher parts of the landscape. Beadle and Eakin soils have a mollic epipedon that is less than 20 inches thick. They are well drained. DeGrey and Walke soils have a natric horizon. Lane soils are well drained. Hoven soils have a natric horizon. They are in positions on the landscape similar to those of the Macken soils.

Typical pedon of Macken silty clay, 1,215 feet east and 1,270 feet south of the northwest corner of sec. 8, T. 100 N., R. 65 W.

A1—0 to 3 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak fine subangular blocky structure parting to moderate fine and medium granular; soft, very friable; slightly acid; clear smooth boundary.

B21—3 to 10 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B22g—10 to 25 inches; dark gray (10YR 4/1) silty clay, very dark gray (5Y 3/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky and weak medium blocky; extremely hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B3gca—25 to 33 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; moderate medium subangular blocky structure parting to weak medium subangular blocky; extremely hard, firm, sticky and plastic; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1gca—33 to 40 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; extremely hard, firm, sticky and plastic; many fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C2gca—40 to 60 inches; light gray (5Y 7/2) silty clay loam, light olive gray (5Y 6/2) moist; many medium distinct yellowish brown (10YR 5/6) mottles; weak thin platy structure; hard, firm, slightly sticky and plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 22 to 34 inches. The thickness of the solum ranges from 30 to 40 inches. The depth to free carbonates ranges from 12 to 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1. It typically is silty clay, but silty clay loam is within the range. The B2 horizon is neutral in hue or has hue of 10YR. It has value of 4 or 5 (2 or 3 moist) and chroma of 0 or 1. It is silty clay or silty clay loam and is neutral or mildly alkaline. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 1 to 3. It is silty clay or silty clay loam. The mottles and accumulations of carbonate range from few to many.

### Napa series

The Napa series consists of deep, poorly drained soils formed in clayey and silty alluvium on flood plains. Permeability is very slow. Slopes are less than 2 percent.

Napa soils are similar to Hoven soils and commonly are near Bon, Farmsworth, and Lane soils. All of the nearby soils are slightly higher on the landscape than the Napa soils. Bon soils do not have a natric horizon and contain less clay in the subsoil than the Napa soils. Farmsworth soils are somewhat poorly drained. Hoven soils are deeper to visible salts than the Napa soils. They are in depressions. Lane soils are well drained. They do not have a natric horizon.

Typical pedon of Napa silt loam, 644 feet east and 86 feet south of the northwest corner of sec. 27, T. 98 N., R. 63 W.

- A2—0 to 1 inch; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak thin platy structure; soft, very friable; mildly alkaline; abrupt smooth boundary.
- B21t—1 to 7 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong coarse columnar structure parting to moderate medium and fine subangular blocky; extremely hard, firm, sticky and plastic; light gray (10YR 6/1) coatings on the tops of columns; mildly alkaline; clear smooth boundary.
- B22tcs—7 to 16 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate coarse and medium prismatic structure parting to strong fine and medium blocky; very hard, firm, sticky and plastic; common fine streaks of gypsum crystals and salts; mildly alkaline; clear wavy boundary.
- B3cs—16 to 29 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate coarse subangular blocky structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; common fine and medium streaks and nests of gypsum crystals; mildly alkaline; clear wavy boundary.
- C1ca—29 to 38 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium

subangular blocky structure parting to weak fine subangular blocky; very hard, firm, sticky and plastic; common medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

- C2gca—38 to 43 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; common fine distinct olive (5Y 5/6) mottles; weak medium subangular blocky structure parting to weak fine subangular blocky; very hard, firm, sticky and plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.
- C3g—43 to 51 inches; light gray (5Y 6/1) silty clay, gray (5Y 5/1) moist; common fine distinct olive (5Y 5/6), dark yellowish brown (10YR 4/6), and yellowish brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; slight effervescence; moderately alkaline; gradual wavy boundary.
- C4g—51 to 60 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; many medium and coarse dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; slight effervescence; common fine and medium accumulations of iron and manganese oxide; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The thickness of the solum ranges from 20 to 35 inches. The depth to free carbonates ranges from 10 to 40 inches. The depth to accumulations of salts and gypsum ranges from 1 to 16 inches.

The A2 horizon has value of 5 to 7 (3 or 4 moist). The B2t horizon has hue of 10YR, 2.5Y, or 5Y and value of 3 or 4 (2 or 3 moist). It is silty clay or clay. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 3. It has few to many mottles. It is silty clay, silty clay loam, or clay.

### Onita series

The Onita series consists of deep, moderately well drained soils formed in local alluvium in swales on uplands. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Onita soils are similar to Homme and Lane soils and commonly are near Eakin, Highmore, Hoven, and Tetonka soils. Eakin, Highmore, and Homme soils have a mollic epipedon that is less than 20 inches thick. They are on the higher parts of the landscape. Hoven and Tetonka soils are poorly drained and are in depressions. Lane soils are more shallow to carbonates than the Onita soils.

Typical pedon of Onita silt loam, in an area of Onita-Tetonka silt loams, 1,584 feet east and 210 feet south of the northwest corner of sec. 12, T. 98 N., R. 65 W.

- Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) moist; weak medium

granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

- A12—7 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, very friable; neutral; gradual wavy boundary.
- B21t—15 to 24 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; shiny films on faces of peds; neutral; clear wavy boundary.
- B22t—24 to 32 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; neutral; clear wavy boundary.
- B3ca—32 to 38 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; very hard, friable, slightly sticky and plastic; strong effervescence; moderately alkaline; clear wavy boundary.
- C1ca—38 to 48 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; few fine faint light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure parting to weak fine subangular blocky; very hard, friable, slightly sticky and plastic; few medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.
- 11C2ca—48 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/8) and gray (2.5Y 6/0) mottles; massive; very hard, friable, slightly sticky and slightly plastic; few medium accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The thickness of the solum ranges from 25 to 45 inches. The depth to free carbonates ranges from 25 to 50 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is silt loam or silty clay loam. The B2t horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 to 3. It is silty clay loam or silty clay. It is slightly acid or neutral. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It has few to many, faint or distinct mottles. It is silt loam, silty clay loam, clay loam, or loam.

### Prosper series

The Prosper series consists of deep, moderately well drained soils formed in loamy glacial till or in local

alluvium over glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are in swales in the uplands. Slopes range from 0 to 3 percent.

Prosper soils are similar to Davis soils and commonly are near Clarno, Stickney, and Tetonka soils. Clarno soils have a mollic epipedon that is less than 20 inches thick. They are on the higher parts of the landscape. Davis soils do not have an argillic horizon. Stickney soils have a natric horizon. They are in an intermediate position on the landscape between the Clarno and Tetonka soils. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Prosper loam, in an area of Clarno-Prosper loams, 0 to 2 percent slopes, 230 feet west and 2,165 feet north of the southeast corner of sec. 14, T. 100 N., R. 62 W.

- Ap—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium and coarse granular structure; very hard, friable; medium acid; abrupt smooth boundary.
- A12—7 to 12 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium and fine granular; very hard, friable; medium acid; clear wavy boundary.
- B21t—12 to 25 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to strong medium and fine blocky; hard, friable, sticky and plastic; shiny films on faces of peds; neutral; gradual wavy boundary.
- B22t—25 to 31 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine blocky; extremely hard, friable, sticky and plastic; shiny films on faces of peds; neutral; clear wavy boundary.
- B3ca—31 to 35 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; extremely hard, friable; few fine accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.
- C1ca—35 to 51 inches; light gray (2.5Y 7/2) loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.
- C2—51 to 60 inches; pale yellow (2.5Y 7/4) loam, olive brown (2.5Y 4/4) moist; common fine distinct light olive brown (2.5Y 5/6) and few fine distinct yellowish red (5YR 5/8) mottles; massive; slightly hard, friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 30 inches. The thickness of the solum ranges from 24 to 40 inches. The depth to free carbonates ranges from 25 to 35 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B2t horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 or 2. The B3ca and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. The C horizon is loam or clay loam. It has few to many distinct mottles. Gypsum crystals are in some pedons.

### Stickney series

The Stickney series consists of deep, moderately well drained soils formed in glacial till on uplands.

Permeability is slow. Slopes range from 0 to 3 percent.

Stickney soils are similar to Farmsworth and Walke soils and commonly are near Clarno, Prosper, and Tetonka soils. Clarno and Prosper soils do not have a natric horizon. Clarno soils are on the higher parts of the landscape, and Prosper soils are in swales. Farmsworth soils are somewhat poorly drained, and Walke soils are well drained. Tetonka soils are poorly drained and are in depressions.

Typical pedon of Stickney loam, in an area of Clarno-Stickney-Prosper loams, 0 to 3 percent slopes, 208 feet west and 1,056 feet north of the southeast corner of sec. 14, T. 100 N., R. 62 W.

- A1—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak very thin platy structure parting to weak fine granular; slightly hard, very friable; medium acid; clear wavy boundary.
- A2—6 to 11 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; dark gray (10YR 4/1) patches; moderate thin platy structure parting to weak fine granular; slightly hard, very friable; slightly acid; clear smooth boundary.
- B&A—11 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam (B), very dark brown (10YR 2/2) moist, and light gray (10YR 7/1) silt loam (A2), very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable; neutral; clear wavy boundary.
- B21t—13 to 20 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate medium prismatic structure parting to strong medium and fine blocky; extremely hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.
- B22t—20 to 25 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium and fine blocky; extremely hard, firm, sticky and plastic; mildly alkaline; gradual irregular boundary.
- B31cs—25 to 30 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak

medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, slightly sticky and slightly plastic; common fine and medium nests of gypsum; slight effervescence; mildly alkaline; clear wavy boundary.

- B32cs—30 to 34 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; hard, friable; common fine and medium nests of gypsum; slight effervescence; moderately alkaline; clear wavy boundary.

- C1cacs—34 to 42 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; few fine faint light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; hard, friable; common fine nests of gypsum; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

- C2ca—42 to 60 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; common medium distinct light olive brown (2.5Y 5/6) and light gray (10YR 7/1) mottles; massive; hard, friable; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The thickness of the solum ranges from 20 to 35 inches. The depth to free carbonates ranges from 20 to 35 inches. Accumulations of gypsum and other salts are below a depth of 24 inches.

The A1 horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam, but silt loam is within the range. The A2 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 to 3. The B2t horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 or 2. It is clay loam or silty clay loam. It is neutral or mildly alkaline. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is loam or clay loam. The mottles, the accumulations of carbonate, and the nests of gypsum range from few to many.

### Talmo series

The Talmo series consists of excessively drained soils that are very shallow over sand and gravel. These soils formed in gravelly outwash on terraces. Permeability is rapid. Slopes range from 2 to 9 percent.

Talmo soils are similar to Delmont soils and commonly are near Enet soils. Delmont soils are 14 to 20 inches deep over gravelly sand, and Enet soils are 20 to 40 inches deep over gravelly sand. Both are on the lower parts of the landscape.

Typical pedon of Talmo loam, in an area of Delmont-Talmo loams, 2 to 9 percent slopes, 156 feet north and 186 feet west of the southeast corner of sec. 7, T. 100 N., R. 66 W.

A1—0 to 6 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, very friable; mildly alkaline; clear smooth boundary.

ACca—6 to 8 inches; grayish brown (10YR 5/2) gravelly sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; many medium and fine accumulations of carbonate; violent effervescence; mildly alkaline; clear smooth boundary.

IIC1ca—8 to 60 inches; multicolored gravelly sand; single grain; loose; accumulations of carbonate on the undersides of pebbles; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 14 inches. The solum is 7 to 10 inches thick. The depth to free carbonates ranges from 0 to 8 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam, but gravelly sandy loam, gravelly loam, and sandy loam are within the range. The IICca horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

### Tetonka series

The Tetonka series consists of deep, poorly drained soils formed in local alluvial deposits over glacial till in depressions on uplands. Permeability is very slow or slow. Slopes are less than 1 percent.

Tetonka soils are similar to Worthing soils and commonly are near Clarno, Highmore, Hoven, Onita, and Prosper soils. Clarno and Highmore soils are well drained and are on the higher parts of the landscape. Hoven soils have a natric horizon. They are in positions on the landscape similar to those of the Tetonka soils. Onita and Prosper soils are moderately well drained and are in swales. Worthing soils are very poorly drained.

Typical pedon of Tetonka silt loam, in an area of Onita-Tetonka silt loams, 156 feet north and 2,225 feet east of the southwest corner of sec. 13, T. 100 N., R. 66 W.

A1—0 to 7 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, very friable; neutral; clear wavy boundary.

A2—7 to 11 inches; light gray (10YR 7/1) silt loam, dark gray (10YR 4/1) moist; common fine faint dark yellowish brown (10YR 4/6) mottles; weak medium platy structure parting to weak medium and fine granular; soft, very friable; neutral; clear wavy boundary.

B&A—11 to 13 inches; dark gray (10YR 4/1) silty clay loam (B2t), black (10YR 2/1) moist, and gray (10YR 5/1) silty clay loam (A2), very dark gray (10YR 3/1)

moist; common fine distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure parting to weak fine subangular blocky; hard, friable; slightly acid; gradual smooth boundary.

B21t—13 to 17 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to strong medium subangular blocky; extremely hard, very firm, sticky and plastic; shiny films on faces of peds; slightly acid; gradual wavy boundary.

B22t—17 to 27 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm, sticky and plastic; shiny films on faces of peds; slightly acid; gradual wavy boundary.

B31—27 to 31 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; thin shiny films on faces of peds; neutral; gradual wavy boundary.

B32—31 to 36 inches; dark gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) moist; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm, sticky and plastic; neutral; clear wavy boundary.

C1—36 to 46 inches; light gray (5Y 7/1) clay loam, gray (5Y 5/1) moist; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; mildly alkaline; gradual wavy boundary.

C2—46 to 60 inches; light gray (5Y 7/1) clay loam, gray (5Y 5/1) moist; many medium prominent yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 25 to 50 inches. The thickness of the solum ranges from 30 to 50 inches. The depth to free carbonates ranges from 36 to 56 inches.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The A2 horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. The B2t horizon has value of 4 or 5 (2 to 4 moist) and chroma of 1 or 2. It is silty clay or clay and ranges from slightly acid to mildly alkaline. The lower part of the B horizon and the C horizon have few to many mottles. In some pedons they have accumulations of gypsum. The C horizon is clay loam, silty clay, or silty clay loam.

### Walke series

The Walke series consists of deep, well drained soils formed in a silty and clayey mantle over clay loam glacial till on uplands. Permeability is moderately slow or slow. Slopes range from 0 to 4 percent.

Walke soils are similar to DeGrey, Farmsworth, and Stickney soils and commonly are near Eakin, Highmore, and Onita soils. DeGrey and Stickney soils are moderately well drained. Eakin, Highmore, and Onita soils do not have a natric horizon. Eakin and Highmore soils are on the higher parts of the landscape. Farmsworth soils are somewhat poorly drained. Onita soils are in swales.

Typical pedon of Walke silt loam, in an area of DeGrey-Walke silt loams, 0 to 4 percent slopes, 495 feet south and 165 feet east of the northwest corner of sec. 21, T. 100 N., R. 66 W.

- A1—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak medium and fine subangular blocky structure parting to weak medium and fine granular; slightly hard, very friable; neutral; clear smooth boundary.
- B&A—7 to 11 inches; dark gray (10YR 4/1) silt loam (B), very dark gray (10YR 3/1) moist, and gray (10YR 6/1) silt loam (A2), very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.
- B2t—11 to 23 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; neutral; clear wavy boundary.
- B3cacs—23 to 32 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; very hard, firm; common fine accumulations of carbonate; strong effervescence; common fine nests and seams of gypsum; moderately alkaline; gradual wavy boundary.
- IIC1cacs—32 to 47 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable; few medium accumulations of carbonate; slight effervescence; common fine and medium nests and seams of gypsum; moderately alkaline; clear wavy boundary.
- IIC2cs—47 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable; strong effervescence; common fine and medium nests and seams of gypsum; mildly alkaline.

The thickness of the mollic epipedon ranges from 12 to 26 inches. The thickness of the solum ranges from 20 to 33 inches. The depth to free carbonates ranges from 12 to 24 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The B2t horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is silty clay loam or silty clay and is neutral or mildly alkaline. The C horizon

has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (3 to 6 moist), and chroma of 1 to 4. It is clay loam, loam, or silty clay loam. The mottles, the accumulations of carbonate, and the nests and seams of gypsum range from few to many.

## Worthing series

The Worthing series consists of deep, very poorly drained soils formed in local alluvial sediments in depressions on glacial till uplands. Permeability is slow. Slopes are less than 1 percent.

Worthing soils are similar to Tetonka soils and commonly are near Clarno, Highmore, Onita, and Prosper soils. Clarno and Highmore soils are well drained and are on the higher parts of the landscape. Onita and Prosper soils are moderately well drained and are in swales. Tetonka soils are poorly drained. They have an A2 horizon.

Typical pedon of Worthing silty clay loam, 103 feet south and 398 feet west of the northeast corner of sec. 27, T. 99 N., R. 65 W.

- A1—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium granular structure; extremely hard, friable; neutral; clear wavy boundary.
- B21t—8 to 18 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; few fine faint olive (5Y 5/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; neutral; clear wavy boundary.
- B22t—18 to 31 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; few fine faint olive (5Y 5/4) mottles; moderate medium prismatic structure parting to strong fine blocky; very hard, firm, sticky and plastic; neutral; gradual wavy boundary.
- B23t—31 to 43 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; few fine faint olive (5Y 5/4) mottles; weak medium subangular blocky structure; very hard, very firm, very sticky and plastic; neutral; gradual wavy boundary.
- B3gca—43 to 52 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; common fine distinct olive (5Y 5/4 and 5/6) mottles; weak medium subangular blocky structure; very hard, firm, sticky and plastic; few fine manganese stains; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.
- Cgca—52 to 60 inches; light gray (5Y 7/2) silty clay, olive gray (5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; very hard, friable; common medium accumulations of carbonate; few concretions of iron and manganese oxide; common small snail shells; strong effervescence; mildly alkaline.

The mollic epipedon is more than 35 inches thick. The thickness of the solum ranges from 45 to 55 inches. The depth to free carbonates ranges from 35 to 55 inches.

The A horizon is neutral in hue or has hue of 10YR, value of 3 or 4 (2 moist), and chroma of 1. It typically is silty clay loam, but silt loam and silty clay are within the

range. The B2t horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1. It is silty clay or clay. It is slightly acid or neutral. The B3g and Cg horizons are silty clay, silty clay loam, or clay loam. They are neutral or mildly alkaline. The mottles and the accumulations of carbonate range from few to many.

# formation of the soils

---

Soil forms when soil-forming processes act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Douglas County.

## climate

Climate directly affects the rate of chemical and physical weathering. Douglas County has a continental climate, which generally is characterized by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. It also favors a moderately slow rate of weathering or soil formation. The climate generally is uniform throughout the county. Therefore, climate alone does not account for differences among the soils in the county. Detailed information about the climate is given under the heading "General nature of the county."

## plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Douglas County the prairie grasses have had more

influence than other living organisms on soil formation. The nearly level Bon soils contain more organic matter than the more sloping Betts soils because they have a more extensive grass cover. As a result, more nutrients are released for plant food. Earthworms, insects, and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose plant residue, thus releasing nutrients that plants use as food.

## parent material

Many of the soils in Douglas County formed in glacial material derived from preglacial formations of granite, gneiss, limestone, sandstone, and shale. The glacier ground up and mixed these materials as it transported them. It then redeposited them as it melted. Some deposits consist of material sorted either by water as the material was deposited or by wind and water after it was deposited; others consist of unsorted material or glacial till.

Glacial deposits of Late Wisconsin age are on the surface throughout most of the county (4). These deposits consist mainly of silty glacial drift, poorly sorted glacial till, stratified glacial outwash, and stratified loamy glacial drift. The glacial drift in the western part of the county has a high content of silt, weathers to light yellowish brown silt loam, is friable, and contains a few fragments of shale or stones. DeGrey, Eakin, Highmore, and Walke soils formed in silty drift. The glacial till in the north-central and northeastern parts of the county is loam or clay loam that contains small fragments of shale and small stones and rocks. Betts, Clarno, Ethan, Prosper, and Stickney soils formed in this glacial till.

Glacial outwash consists of sand, gravel, and loamy material deposited by glacial melt water. Delmont, Enet, and Talmo soils formed in loamy glacial outwash underlain by gravelly sand within a depth of 40 inches. Blendon and Henkin soils formed in loamy and sandy melt water deposits.

Hoven, Prosper, and Tetonka soils formed partly or entirely in local alluvium washed in from sloping adjacent soils in the uplands. Bon soils formed in alluvium deposited by streams.

## relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil

temperature. On the steeper soils, such as Betts soils, much of the rainfall is lost through runoff and thus does not penetrate the surface. Much of the surface soil is lost through erosion. As a result, these soils have a thin surface layer and are calcareous at or near the surface. Runoff is less rapid on Clarno, Highmore, and other less sloping soils, and more moisture penetrates the surface. These soils are calcareous at a greater depth than the Betts soils. Also, the horizons in which organic matter accumulates are thicker.

Prosper soils are in swales that receive runoff from adjacent soils. The horizons in which organic matter accumulates are thicker than those in the Clarno and Highmore soils. Tetonka soils are in depressions where water ponds. They have the colors and mottles characteristic of poorly drained soils.

## time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that form. The degree of profile development reflects the age of a soil. The oldest soils are on the parts of the landscape that have been stable for the longest time. In Douglas County these are the Clarno, Highmore, and Homme soils. The youngest soils either are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time they are flooded. Betts soils are an example of young soils that are subject to natural erosion, and Bon soils are an example of young alluvial soils.

## references

---

- (1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vols., illus.
- (2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.
- (3) Baumberger, Rodney. 1977. South Dakota range-land resources. Old West Reg. Comm. 150 pp., illus.
- (4) Flint, Richard Foster. 1955. Pleistocene geology of eastern South Dakota. U.S. Geol. Surv., Prof. Pap. 262, 173 pp., illus.
- (5) South Dakota Crop and Livestock Reporting Service. 1969. Douglas County agriculture. 62 pp.
- (6) South Dakota Crop and Livestock Reporting Service. 1976. South Dakota agriculture—1975. 94 pp., illus.
- (7) United States Department of Agriculture. 1927. Soil survey of Douglas County, South Dakota. Bur. of Soils, 22 pp., illus.
- (8) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]
- (9) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.
- (10) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.



# glossary

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low.....	0 to 3
Low.....	3 to 6
Moderate.....	6 to 9
High.....	9 to 12
Very high.....	more than 12

**Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

**Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compact layers to depths below normal plow depth.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

**Complex slope.** Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

**Complex, soil.** A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated

compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—  
*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

**Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

**Crop residue management.** Using that part of the plant or crop left in the field after harvest for protection or improvement of the soil.

**Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.

**Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.

**Drainage class** (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

**Excessively drained.**—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

**Somewhat excessively drained.**—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

**Well drained.**—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

**Moderately well drained.**—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

**Somewhat poorly drained.**—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

**Poorly drained.**—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

**Very poorly drained.**—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

**Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

**Erosion (geologic).** Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

**Erosion (accelerated).** Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

**Excess fines** (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

**Excess salts** (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

**Fallow.** Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

**Foot slope.** The inclined surface at the base of a hill.

**Forb.** Any herbaceous plant not a grass or a sedge.

**Frost action** (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

**Glacial drift** (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

**Glacial outwash** (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

**Glacial till** (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

**Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

**Gravel.** Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

**O horizon.**—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

**A horizon.**—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

**B horizon.**—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in

the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

**C horizon.**—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

**R layer.**—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are—

**Border.**—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

**Basin.**—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

**Controlled flooding.**—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

**Corrugation.**—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

**Drip (or trickle).**—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

**Furrow.**—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

**Sprinkler.**—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

**Subirrigation.**—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

**Wild flooding.**—Water, released at high points, is allowed to flow onto an area without controlled distribution.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.

**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Low strength.** The soil is not strong enough to support loads.

**Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percs slowly** (in tables). The slow movement of water through the soil adversely affecting the specified use.

**Permeability.** The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow.....	less than 0.06 inch
Slow.....	0.06 to 0.20 inch
Moderately slow.....	0.2 to 0.6 inch
Moderate.....	0.6 inch to 2.0 inches
Moderately rapid.....	2.0 to 6.0 inches
Rapid.....	6.0 to 20 inches
Very rapid.....	more than 20 inches

**Piping** (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**Ponding.** Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

**Poor filter** (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

**Productivity, soil.** The capability of a soil for producing a specified plant or sequence of plants under specific management.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Rangeland.** Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

**Range site.** An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

**Reaction, soil.** A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid.....	below 4.5
Very strongly acid.....	4.5 to 5.0
Strongly acid.....	5.1 to 5.5
Medium acid.....	5.6 to 6.0
Slightly acid.....	6.1 to 6.5
Neutral.....	6.6 to 7.3
Mildly alkaline.....	7.4 to 7.8
Moderately alkaline.....	7.9 to 8.4
Strongly alkaline.....	8.5 to 9.0
Very strongly alkaline.....	9.1 and higher

**Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Shrink-swell.** The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

**Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

**Slope** (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

**Slow intake** (in tables). The slow movement of water into the soil.

**Small stones** (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

**Soil.** A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates.** Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand.....	2.0 to 1.0
Coarse sand.....	1.0 to 0.5
Medium sand.....	0.5 to 0.25
Fine sand.....	0.25 to 0.10
Very fine sand.....	0.10 to 0.05
Silt.....	0.05 to 0.002
Clay.....	less than 0.002

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

**Subsoil.** Technically, the B horizon; roughly, the part of the profile below plow depth.

**Subsoiling.** Breaking up a compact subsoil by pulling a special chisel through the soil.

**Subsurface layer.** Any surface soil horizon (A1, A2, or A3) below the surface layer.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Surface soil.** The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

**Terrace (geologic).** An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Thin layer** (in tables). Otherwise suitable soil material too thin for the specified use.

**Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

**Topsoll.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Upland (geology).** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.



**tables**

---

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-74 at Armour, South Dakota]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	<u>OF</u>	<u>OF</u>	<u>OF</u>	<u>OF</u>	<u>OF</u>	<u>Units</u>	<u>In</u>	<u>In</u>	<u>In</u>		<u>In</u>
January----	28.3	6.3	17.5	57	-26	0	0.45	0.14	0.69	1	5.0
February---	35.3	12.4	23.9	66	-21	17	.89	.19	1.43	3	8.1
March-----	43.9	21.3	32.6	78	-9	115	1.32	.56	1.93	4	8.4
April-----	61.2	34.6	47.9	90	14	257	2.45	1.31	3.37	5	2.5
May-----	73.0	46.5	59.8	94	26	614	3.07	1.52	4.32	7	.1
June-----	82.0	56.9	69.5	103	39	885	3.96	2.45	5.32	8	.0
July-----	88.5	62.0	75.2	104	45	1,091	3.05	1.37	4.41	6	.0
August-----	87.3	60.1	73.7	103	43	1,045	2.47	1.17	3.53	5	.0
September--	76.4	49.3	62.9	99	30	687	2.14	.77	3.23	4	.0
October----	65.4	38.2	51.8	89	17	380	1.31	.28	2.12	3	.4
November---	47.2	24.1	35.7	74	-2	53	.79	.12	1.31	2	3.1
December---	33.6	12.4	23.0	62	-18	16	.78	.18	1.25	2	7.9
Yearly:											
Average--	60.2	35.3	47.8	---	---	---	---	---	---	---	---
Extreme--	---	---	---	106	-26	---	---	---	---	---	---
Total----	---	---	---	---	---	5,160	22.68	18.83	26.82	50	35.5

\*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-74  
at Armour, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 29	May 14	May 21
2 years in 10 later than--	April 25	May 8	May 17
5 years in 10 later than--	April 15	April 26	May 9
First freezing temperature in fall:			
1 year in 10 earlier than--	October 7	September 27	September 13
2 years in 10 earlier than--	October 13	October 2	September 19
5 years in 10 earlier than--	October 23	October 12	October 1

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-74  
at Armour, South Dakota]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
9 years in 10	171	145	122
8 years in 10	178	153	130
5 years in 10	190	168	144
2 years in 10	202	182	159
1 year in 10	209	190	167

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ar	Arlo loam-----	650	0.2
Ax	Arlo loam, wet-----	110	*
BaB	Beadle clay loam, 2 to 6 percent slopes-----	160	0.1
BeE	Betts-Ethan loams, 15 to 40 percent slopes-----	1,620	0.6
Bn	Bon loam-----	1,280	0.5
Bo	Bon loam, channeled-----	3,460	1.2
CeC	Clarno-Ethan loams, 6 to 9 percent slopes-----	4,200	1.5
CnA	Clarno-Ethan-Prosper loams, 0 to 3 percent slopes-----	9,070	3.3
CnB	Clarno-Ethan-Prosper loams, 1 to 6 percent slopes-----	32,980	11.9
CpA	Clarno-Prosper loams, 0 to 2 percent slopes-----	16,940	6.1
CsA	Clarno-Stickney-Prosper loams, 0 to 3 percent slopes-----	6,690	2.4
DaB	Davis silt loam, 2 to 6 percent slopes-----	400	0.1
DbA	DeGrey-Walke silt loams, 0 to 4 percent slopes-----	7,710	2.8
DeA	Delmont loam, 0 to 2 percent slopes-----	770	0.3
DlB	Delmont-Enet loams, 2 to 6 percent slopes-----	940	0.3
DmC	Delmont-Talmo loams, 2 to 9 percent slopes-----	1,620	0.6
Do	Dimo loam-----	660	0.2
EaA	Eakin-Ethan complex, 0 to 3 percent slopes-----	7,750	2.8
EaB	Eakin-Ethan complex, 3 to 6 percent slopes-----	50,460	18.0
EaC	Eakin-Ethan complex, 6 to 9 percent slopes-----	7,170	2.6
EdA	Enet-Delmont loams, 0 to 2 percent slopes-----	3,350	1.2
EtD	Ethan-Clarno loams, 9 to 15 percent slopes-----	1,830	0.7
Fa	Farmsworth silt loam-----	1,440	0.5
HbA	Henkin-Blendon fine sandy loams, 0 to 2 percent slopes-----	1,570	0.6
HbB	Henkin-Blendon fine sandy loams, 2 to 6 percent slopes-----	1,820	0.7
HeA	Highmore-Eakin silt loams, 0 to 2 percent slopes-----	15,960	5.7
HeB	Highmore-Eakin silt loams, 2 to 6 percent slopes-----	7,800	2.8
HgA	Highmore-Walke silt loams, 0 to 3 percent slopes-----	27,620	9.9
HhB	Homme silty clay loam, 2 to 6 percent slopes-----	810	0.3
HmB	Homme-Ethan complex, 1 to 6 percent slopes-----	1,220	0.4
HnA	Homme-Onita silty clay loams, 0 to 2 percent slopes-----	5,480	2.0
Hv	Hoven silt loam-----	2,990	1.1
La	Lane silty clay loam-----	2,380	0.9
Ma	Macken silty clay-----	2,250	0.8
Na	Napa silt loam-----	810	0.3
Oa	Onita silt loam-----	1,440	0.5
On	Onita-Tetonka silt loams-----	14,290	5.1
Pg	Pits, gravel-----	110	*
Pt	Prosper-Tetonka complex-----	8,650	3.1
TaC	Talmo gravelly sandy loam, 2 to 9 percent slopes-----	380	0.1
Te	Tetonka silt loam-----	14,360	5.2
Wo	Worthing silty clay loam-----	4,130	1.5
Wp	Worthing silty clay loam, ponded-----	2,790	1.0
	Water-----	152	0.1
	Total-----	278,272	100.0

\* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Oats	Grain sorghum	Alfalfa hay	Bromegrass- alfalfa
	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Ton</u>	<u>AUM<sup>W</sup></u>
Ar----- Arlo	45	---	47	3.2	5.3
BaB----- Beadle	48	55	52	2.6	4.3
Bn----- Bon	70	75	75	3.3	5.5
CeC----- Clarno-Ethan	42	49	43	2.0	3.3
CnA----- Clarno-Ethan-Prosper	55	61	55	2.8	4.7
CnB----- Clarno-Ethan-Prosper	53	59	53	2.6	4.3
CpA----- Clarno-Prosper	61	66	60	2.9	4.8
CsA----- Clarno-Stickney-Prosper	54	60	54	2.8	4.7
DaB----- Davis	60	72	63	2.9	4.8
DbA----- DeGrey-Walke	31	39	34	1.5	2.5
DeA----- Delmont	28	32	28	1.2	2.0
DlB----- Delmont-Enet	31	33	31	1.4	2.3
Do----- Dimo	52	65	46	2.2	3.7
EaA----- Eakin-Ethan	48	55	51	2.4	4.0
EaB----- Eakin-Ethan	47	53	50	2.4	4.0
EaC----- Eakin-Ethan	40	48	43	2.0	3.3
EdA----- Enet-Delmont	37	43	37	1.7	2.8
Fa----- Farmsworth	---	42	36	2.0	3.3
HbA----- Henkin-Blendon	50	50	48	2.0	3.3
HbB----- Henkin-Blendon	48	47	44	1.9	3.2
HeA----- Highmore-Eakin	54	63	56	2.7	4.5

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Grain sorghum	Alfalfa hay	Bromegrass- alfalfa
	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Ton</u>	<u>AUM*</u>
HeB----- Highmore-Eakin	53	60	55	2.7	4.5
HgA----- Highmore-Walke	48	57	52	2.5	4.2
HhB----- Homme	61	61	57	2.8	4.7
HmB----- Homme-Ethan	54	58	53	2.6	4.3
HnA----- Homme-Onita	63	65	61	2.9	4.8
La----- Lane	53	70	54	2.8	4.7
Oa----- Onita	66	70	67	3.1	5.2
On----- Onita-Tetonka	60	62	59	2.8	4.7
Pt----- Prosper-Tetonka	62	63	61	2.9	4.8

\* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight Lb/acre		Pct
Ar----- Arlo	Subirrigated-----	Favorable	4,900	Big bluestem-----	40
		Normal	4,500	Indiangrass-----	15
		Unfavorable	3,600	Switchgrass-----	15
				Prairie cordgrass-----	15
				Sedge-----	10
Ax----- Arlo	Wetland-----	Favorable	7,000	Prairie cordgrass-----	55
		Normal	6,400	Big bluestem-----	15
		Unfavorable	5,200	Sedge-----	15
				Indiangrass-----	5
				Switchgrass-----	5
BaB----- Beadle	Clayey-----	Favorable	3,200	Western wheatgrass-----	30
		Normal	2,700	Green needlegrass-----	30
		Unfavorable	1,900	Sideoats grama-----	10
				Blue grama-----	10
				Little bluestem-----	5
				Big bluestem-----	5
				Sedge-----	5
BeE*: Betts-----	Thin Upland-----	Favorable	2,800	Little bluestem-----	40
		Normal	2,300	Sideoats grama-----	15
		Unfavorable	1,600	Needleandthread-----	10
				Blue grama-----	10
				Prairie dropseed-----	10
				Sedge-----	5
				Leadplant-----	5
Ethan-----	Silty-----	Favorable	2,900	Needlegrass-----	35
		Normal	2,400	Little bluestem-----	20
		Unfavorable	1,700	Western wheatgrass-----	15
				Sideoats grama-----	10
				Big bluestem-----	5
				Blue grama-----	5
				Sedge-----	5
Bn----- Bon	Overflow-----	Favorable	4,700	Big bluestem-----	55
		Normal	4,300	Needlegrass-----	15
		Unfavorable	3,000	Western wheatgrass-----	10
				Sideoats grama-----	5
				Leadplant-----	5
				Sedge-----	5
Bo----- Bon	Subirrigated-----	Favorable	5,000	Big bluestem-----	60
		Normal	4,500	Indiangrass-----	10
		Unfavorable	3,600	Switchgrass-----	10
				Sedge-----	5
CeC*: Clarno-----	Silty-----	Favorable	3,300	Needlegrass-----	40
		Normal	2,800	Western wheatgrass-----	20
		Unfavorable	2,000	Sideoats grama-----	10
				Big bluestem-----	10
				Little bluestem-----	5
				Blue grama-----	5
				Sedge-----	5
Ethan-----	Silty-----	Favorable	3,100	Needlegrass-----	35
		Normal	2,600	Western wheatgrass-----	20
		Unfavorable	1,800	Little bluestem-----	15
				Big bluestem-----	10
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight Lb/acre		Pct
CnA*, CnB*: Clarno-----	Silty-----	Favorable	3,600	Needlegrass-----	40
		Normal	3,000	Western wheatgrass-----	20
		Unfavorable	2,100	Big bluestem-----	15
				Little bluestem-----	5
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Ethan-----	Silty-----	Favorable	3,100	Needlegrass-----	35
		Normal	2,600	Western wheatgrass-----	20
		Unfavorable	1,800	Little bluestem-----	15
				Big bluestem-----	10
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Prosper-----	Overflow-----	Favorable	4,700	Big bluestem-----	55
		Normal	4,300	Western wheatgrass-----	15
		Unfavorable	3,000	Green needlegrass-----	10
				Sideoats grama-----	5
				Leadplant-----	5
				Sedge-----	5
CpA*: Clarno-----	Silty-----	Favorable	3,600	Needlegrass-----	40
		Normal	3,000	Western wheatgrass-----	20
		Unfavorable	2,100	Big bluestem-----	15
				Little bluestem-----	5
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Prosper-----	Overflow-----	Favorable	4,700	Big bluestem-----	55
		Normal	4,300	Western wheatgrass-----	15
		Unfavorable	3,000	Green needlegrass-----	10
				Sideoats grama-----	5
				Leadplant-----	5
				Sedge-----	5
CsA*: Clarno-----	Silty-----	Favorable	3,600	Needlegrass-----	40
		Normal	3,000	Western wheatgrass-----	20
		Unfavorable	2,100	Big bluestem-----	15
				Little bluestem-----	5
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Stickney-----	Clayey-----	Favorable	3,400	Western wheatgrass-----	35
		Normal	2,800	Needlegrass-----	30
		Unfavorable	2,000	Sideoats grama-----	10
				Little bluestem-----	5
				Big bluestem-----	5
				Blue grama-----	5
				Sedge-----	5
Prosper-----	Overflow-----	Favorable	4,700	Big bluestem-----	55
		Normal	4,300	Western wheatgrass-----	15
		Unfavorable	3,000	Green needlegrass-----	10
				Sideoats grama-----	5
				Leadplant-----	5
				Sedge-----	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight Lb/acre		Pct
DaB----- Davis	Silty-----	Favorable	3,800	Needlegrass-----	35
		Normal	3,200	Big bluestem-----	15
		Unfavorable	2,200	Western wheatgrass-----	15
				Little bluestem-----	15
				Sideoats grama-----	5
				Leadplant-----	5
DbA*: DeGrey-----	Claypan-----	Favorable	2,800	Western wheatgrass-----	45
		Normal	2,300	Green needlegrass-----	15
		Unfavorable	1,500	Blue grama-----	15
				Sedge-----	10
				Needleandthread-----	5
				Buffalograss-----	5
Walke-----	Clayey-----	Favorable	3,200	Western wheatgrass-----	35
		Normal	2,700	Green needlegrass-----	30
		Unfavorable	1,900	Sideoats grama-----	10
				Blue grama-----	10
				Sedge-----	5
				Little bluestem-----	5
DeA----- Delmont	Shallow to Gravel-----	Favorable	2,500	Needleandthread-----	60
		Normal	2,100	Sedge-----	10
		Unfavorable	1,300	Sideoats grama-----	5
				Prairie dropseed-----	5
				Blue grama-----	5
				Plains muhly-----	5
DlB*: Delmont-----	Shallow to Gravel-----	Favorable	2,500	Needleandthread-----	60
		Normal	2,100	Sedge-----	10
		Unfavorable	1,300	Sideoats grama-----	5
				Prairie dropseed-----	5
				Blue grama-----	5
				Plains muhly-----	5
Enet-----	Silty-----	Favorable	3,600	Needlegrass-----	35
		Normal	3,000	Western wheatgrass-----	20
		Unfavorable	2,100	Little bluestem-----	15
				Big bluestem-----	10
				Sideoats grama-----	5
				Blue grama-----	5
DmC*: Delmont-----	Shallow to Gravel-----	Favorable	2,500	Needleandthread-----	60
		Normal	2,100	Sedge-----	10
		Unfavorable	1,300	Sideoats grama-----	5
				Prairie dropseed-----	5
				Blue grama-----	5
				Plains muhly-----	5
Talmo-----	Very Shallow-----	Favorable	2,000	Blue grama-----	40
		Normal	1,700	Needleandthread-----	25
		Unfavorable	1,000	Sideoats grama-----	10
				Sedge-----	10
Do----- Dimo	Overflow-----	Favorable	4,500	Big bluestem-----	55
		Normal	4,100	Western wheatgrass-----	20
		Unfavorable	2,900	Green needlegrass-----	15
				Leadplant-----	5
				Sedge-----	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight Lb/acre		Pct
EaA*, EaB*, EaC*: Eakin-----	Silty-----	Favorable	3,700	Western wheatgrass-----	35
		Normal	3,100	Green needlegrass-----	20
		Unfavorable	2,200	Big bluestem-----	10
				Needleandthread-----	10
				Little bluestem-----	5
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Ethan-----	Silty-----	Favorable	3,100	Needlegrass-----	35
		Normal	2,600	Western wheatgrass-----	20
		Unfavorable	1,800	Little bluestem-----	15
				Big bluestem-----	10
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
EdA*: Enet-----	Silty-----	Favorable	3,600	Needlegrass-----	35
		Normal	3,000	Western wheatgrass-----	20
		Unfavorable	2,100	Little bluestem-----	15
				Big bluestem-----	10
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Delmont-----	Shallow to Gravel-----	Favorable	2,500	Needleandthread-----	60
		Normal	2,100	Sedge-----	10
		Unfavorable	1,300	Sideoats grama-----	5
				Prairie dropseed-----	5
				Blue grama-----	5
				Plains muhly-----	5
EtD*: Ethan-----	Silty-----	Favorable	2,900	Needlegrass-----	35
		Normal	2,400	Little bluestem-----	20
		Unfavorable	1,700	Western wheatgrass-----	15
				Sideoats grama-----	10
				Big bluestem-----	5
				Blue grama-----	5
				Sedge-----	5
Clarno-----	Silty-----	Favorable	3,300	Needlegrass-----	40
		Normal	2,800	Western wheatgrass-----	20
		Unfavorable	2,000	Big bluestem-----	10
				Sideoats grama-----	10
				Little bluestem-----	5
				Blue grama-----	5
				Sedge-----	5
Fa----- Farmsworth	Claypan-----	Favorable	2,900	Western wheatgrass-----	50
		Normal	2,400	Blue grama-----	15
		Unfavorable	1,700	Green needlegrass-----	10
				Sedge-----	10
				Buffalograss-----	5
HbA*: Henkin-----	Sandy-----	Favorable	3,500	Little bluestem-----	35
		Normal	2,900	Prairie sandreed-----	15
		Unfavorable	2,000	Big bluestem-----	10
				Needleandthread-----	10
				Blue grama-----	10
				Porcupinegrass-----	5
				Leadplant-----	5
				Sedge-----	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight Lb/acre		Pct
HbA*: Blendon-----	Sandy-----	Favorable	3,500	Little bluestem-----	35
		Normal	2,900	Prairie sandreed-----	15
		Unfavorable	2,000	Big bluestem-----	10
				Needleandthread-----	10
				Blue grama-----	10
				Porcupinegrass-----	5
				Leadplant-----	5
				Sedge-----	5
HbB*: Henkin-----	Sandy-----	Favorable	3,200	Little bluestem-----	40
		Normal	2,700	Prairie sandreed-----	15
		Unfavorable	1,900	Needleandthread-----	10
				Blue grama-----	10
				Big bluestem-----	5
				Porcupinegrass-----	5
				Leadplant-----	5
				Sedge-----	5
Blendon-----	Sandy-----	Favorable	3,500	Little bluestem-----	35
		Normal	2,900	Prairie sandreed-----	15
		Unfavorable	2,000	Big bluestem-----	10
				Needleandthread-----	10
				Blue grama-----	10
				Porcupinegrass-----	5
				Leadplant-----	5
				Sedge-----	5
HeA*, HeB*: Highmore-----	Silty-----	Favorable	3,700	Western wheatgrass-----	35
		Normal	3,100	Green needlegrass-----	20
		Unfavorable	2,200	Big bluestem-----	10
				Needleandthread-----	10
				Little bluestem-----	5
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Eakin-----	Silty-----	Favorable	3,700	Western wheatgrass-----	35
		Normal	3,100	Green needlegrass-----	20
		Unfavorable	2,200	Big bluestem-----	10
				Needleandthread-----	10
				Little bluestem-----	5
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
HgA*: Highmore-----	Silty-----	Favorable	3,700	Western wheatgrass-----	35
		Normal	3,100	Green needlegrass-----	20
		Unfavorable	2,200	Big bluestem-----	10
				Needleandthread-----	10
				Little bluestem-----	5
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
Walke-----	Clayey-----	Favorable	3,200	Western wheatgrass-----	35
		Normal	2,700	Green needlegrass-----	30
		Unfavorable	1,900	Sideoats grama-----	10
				Blue grama-----	10
				Sedge-----	5
				Little bluestem-----	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight Lb/acre		Pct
HhB----- Homme	Silty-----	Favorable	3,800	Western wheatgrass-----	30
		Normal	3,200	Green needlegrass-----	20
		Unfavorable	2,200	Big bluestem-----	15
				Needleandthread-----	10
				Blue grama-----	5
				Little bluestem-----	5
				Sedge-----	5
				Sideoats grama-----	5
HmB*: Homme-----	Silty-----	Favorable	3,800	Western wheatgrass-----	30
		Normal	3,200	Green needlegrass-----	20
		Unfavorable	2,200	Big bluestem-----	15
				Needleandthread-----	10
				Blue grama-----	5
				Little bluestem-----	5
				Sedge-----	5
				Sideoats grama-----	5
Ethan-----	Silty-----	Favorable	3,100	Needlegrass-----	35
		Normal	2,600	Western wheatgrass-----	20
		Unfavorable	1,800	Little bluestem-----	15
				Big bluestem-----	10
				Sideoats grama-----	5
				Blue grama-----	5
				Sedge-----	5
HnA*: Homme-----	Silty-----	Favorable	3,800	Western wheatgrass-----	30
		Normal	3,200	Green needlegrass-----	20
		Unfavorable	2,200	Big bluestem-----	15
				Needleandthread-----	10
				Blue grama-----	5
				Little bluestem-----	5
				Sedge-----	5
				Sideoats grama-----	5
Onita-----	Silty-----	Favorable	3,800	Big bluestem-----	20
		Normal	3,200	Green needlegrass-----	20
		Unfavorable	2,200	Western wheatgrass-----	15
				Needleandthread-----	15
				Little bluestem-----	10
				Sideoats grama-----	5
				Sedge-----	5
Hv----- Hoven	Closed Depression-----	Favorable	3,900	Western wheatgrass-----	85
		Normal	3,500	Sedge-----	10
		Unfavorable	2,500		
La----- Lane	Clayey-----	Favorable	3,300	Western wheatgrass-----	40
		Normal	2,800	Green needlegrass-----	30
		Unfavorable	2,000	Blue grama-----	10
				Big bluestem-----	5
				Sideoats grama-----	5
				Sedge-----	5
Ma----- Macken	Closed Depression-----	Favorable	3,900	Western wheatgrass-----	80
		Normal	3,500	Sedge-----	10
		Unfavorable	2,500	Blue grama-----	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight Lb/acre		Pct
Na----- Napa	Saline Lowland-----	Favorable	3,500	Western wheatgrass-----	30
		Normal	3,200	Cordgrass-----	25
		Unfavorable	2,600	Nuttall alkaligrass-----	20
				Saltgrass-----	10
				Bluegrass-----	5
Oa----- Onita	Overflow-----	Favorable	4,950	Big bluestem-----	60
		Normal	4,500	Green needlegrass-----	10
		Unfavorable	3,150	Western wheatgrass-----	5
				Sideoats grama-----	5
				Little bluestem-----	5
				Leadplant-----	5
				Sedge-----	5
On*: Onita-----	Overflow-----	Favorable	4,950	Big bluestem-----	60
		Normal	4,500	Green needlegrass-----	10
		Unfavorable	3,150	Western wheatgrass-----	5
				Sideoats grama-----	5
				Little bluestem-----	5
				Leadplant-----	5
				Sedge-----	5
Tetonka-----	Wet Meadow-----	Favorable	4,800	Sedge-----	30
		Normal	4,200	Prairie cordgrass-----	25
		Unfavorable	2,900	Western wheatgrass-----	15
				Reedgrass-----	15
				Bluegrass-----	5
Pt*: Prosper-----	Overflow-----	Favorable	4,700	Big bluestem-----	55
		Normal	4,300	Western wheatgrass-----	15
		Unfavorable	3,000	Green needlegrass-----	10
				Sideoats grama-----	5
				Leadplant-----	5
				Sedge-----	5
Tetonka-----	Wet Meadow-----	Favorable	4,800	Sedge-----	30
		Normal	4,200	Prairie cordgrass-----	25
		Unfavorable	2,900	Western wheatgrass-----	15
				Reedgrass-----	15
				Bluegrass-----	5
TaC----- Talmo	Very Shallow-----	Favorable	2,000	Blue grama-----	40
		Normal	1,700	Needleandthread-----	25
		Unfavorable	1,000	Sideoats grama-----	10
				Sedge-----	10
				Plains muhly-----	5
Te----- Tetonka	Wet Meadow-----	Favorable	4,800	Sedge-----	30
		Normal	4,200	Prairie cordgrass-----	25
		Unfavorable	2,900	Western wheatgrass-----	15
				Reedgrass-----	15
				Bluegrass-----	5
Wo----- Worthing	Shallow Marsh-----	Favorable	6,800	Slough sedge-----	35
		Normal	6,200	Rivergrass-----	30
		Unfavorable	5,000	Prairie cordgrass-----	10
				Reedgrass-----	10

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ar----- Arlo	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Ax. Arlo					
BaB----- Beadle	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
BeE*: Betts.  Ethan.					
Bn----- Bon	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Bo. Bon					
CeC*: Clarno-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Ethan-----	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm-----	---	---
CnA*, CnB*: Clarno-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
CnA*, CnB*: Ethan-----	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm-----	---	---
Prosper-----	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Blue spruce, green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine.	Eastern cottonwood.
CpA*: Clarno-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Prosper-----	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Blue spruce, green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine.	Eastern cottonwood.
CsA*: Clarno-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Stickney-----	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
Prosper-----	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Blue spruce, green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine.	Eastern cottonwood.
DaB----- Davis	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
DbA*: DeGrey-----	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Walke-----	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
DeA----- Delmont	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm-----	---	---
DlB*: Delmont-----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm-----	---	---
Enet-----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm-----	---	---
DmC*: Delmont-----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm-----	---	---
Talmo.					
Do----- Dimo	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
EaA*, EaB*, EaC*: Eakin-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Ethan-----	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm-----	---	---
EdA*: Enet-----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm-----	---	---
Delmont-----	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm-----	---	---
EtD*: Ethan.					
Clarno-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Fa----- Farmsworth	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
HbA*, HbB*: Henkin-----	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
HbA*, HbB*: Blendon-----	Silver buffaloberry, Peking cotoneaster, lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Siberian crabapple, Russian-olive.	---	---
HeA*, HeB*: Highmore-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Eakin-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
HgA*: Highmore-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Walke-----	Peking cotoneaster, lilac.	Siberian crabapple, common chokecherry, American plum, silver buffaloberry, Siberian peashrub.	Green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	---
HhB----- Homme	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
HmB*: Homme-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
HmB*: Ethan-----	Tatarian honeysuckle, American plum, lilac, Peking cotoneaster.	Ponderosa pine, Russian-olive, green ash, common hackberry, Rocky Mountain juniper, eastern redcedar, Siberian peashrub.	Siberian elm-----	---	---
HnA*: Homme-----	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Onita-----	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Hv. Hoven					
La----- Lane	Lilac-----	Eastern redcedar, common chokecherry, Siberian peashrub, American plum, silver buffaloberry.	Ponderosa pine, green ash, common hackberry, Russian-olive, Siberian crabapple.	Blue spruce-----	---
Ma. Macken					
Na. Napa					
Oa----- Onita	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
On*: Onita-----	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Tetonka-----	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Pg#. Pits					
Pt*: Prosper-----	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Blue spruce, green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine.	Eastern cottonwood.
Tetonka-----	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
TaC. Talmo					
Te. Tetonka					
Wo, Wp. Worthing					

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Ar----- Arlo	Fair	Poor	Fair	Good	Fair	Fair	Fair	Fair	Fair.
Ax----- Arlo	Very poor	Poor	Fair	Good	Fair	Fair	Very poor	Fair	Fair.
BaB----- Beadle	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
BeE*: Betts-----	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Ethan-----	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Bn----- Bon	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Bo----- Bon	Very poor	Good	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
CeC*: Clarno-----	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Ethan-----	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
CnA*, CnB*: Clarno-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan-----	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Prosper-----	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
CpA*: Clarno-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Prosper-----	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
CsA*: Clarno-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Stickney-----	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Prosper-----	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
DaB----- Davis	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
DbA*: DeGrey-----	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
Walke-----	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
DeA----- Delmont	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
DlB*: Delmont-----	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Enet-----	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
DmC*: Delmont-----	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
DmC*: Talmo-----	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Do----- Dimo	Fair	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
EaA*, EaB*: Eakin-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan-----	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
EaC*: Eakin-----	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Ethan-----	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
EdA*: Enet-----	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Delmont-----	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
EtD*: Ethan-----	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Clarno-----	Poor	Good	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
Fa----- Farmsworth	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
HbA*, HbB*: Henkin-----	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Blendon-----	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
HeA*, HeB*: Highmore-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Eakin-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
HgA*: Highmore-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Walke-----	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
HhB----- Homme	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
HmB*: Homme-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan-----	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
HnA*: Homme-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Onita-----	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Hv----- Hoven	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
La----- Lane	Good	Fair	Good	Good	Very poor	Very poor	Good	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Ma----- Macken	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
Na----- Napa	Very poor	Very poor	Fair	Poor	Poor	Poor	Very poor	Poor	Fair.
Oa----- Onita	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
On*: Onita-----	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Tetonka-----	Good	Good	Poor	Poor	Fair	Fair	Fair	Fair	Poor.
Pg*. Pits									
Pt*: Prosper-----	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Tetonka-----	Good	Good	Poor	Poor	Fair	Fair	Fair	Fair	Poor.
TaC----- Talmo	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Te----- Tetonka	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Fair	Poor.
Wo----- Worthing	Very poor	Poor	Fair	Poor	Good	Good	Very poor	Good	Fair.
Wp----- Worthing	Very poor	Very poor	Very poor	Very poor	Good	Good	Very poor	Good	Very poor.

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ar, Ax----- Arlo	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
BaB----- Beadle	Moderate: too clayey:	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
BeE*: Betts-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Ethan-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Bn----- Bon	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Bo----- Bon	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods, frost action.
CeC*: Clarno-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Ethan-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
CnA*: Clarno-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Ethan-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Prosper-----	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
CnB*: Clarno-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Ethan-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Prosper-----	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
CpA*: Clarno-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
CpA*: Prosper-----	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
CsA*: Clarno-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Stickney-----	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Prosper-----	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
DaB----- Davis	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
DbA*: DeGrey-----	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Walke-----	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
DeA----- Delmont	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight.
DiB*: Delmont-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight.
Enet-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight.
DmC*: Delmont-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight.
Talmo-----	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight.
Do----- Dimo	Severe: cutbanks cave, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: low strength, floods, frost action.
EaA*: Eakin-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Ethan-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
EaB*, EaC*: Eakin-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
EaB*, EaC*: Ethan-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
EdA*: Enet-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight.
Delmont-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight.
EtD*: Ethan-----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
Clarno-----	Moderate: slope..	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Fa----- Farmsworth	Moderate: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
HbA*: Henkin-----	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: frost action.
Blendon-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Moderate: frost action.
HbB*: Henkin-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.
Blendon-----	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Moderate: frost action.
HeA*: Highmore-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Eakin-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
HeB*: Highmore-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Eakin-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
HgA*: Highmore-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Walke-----	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
HhB----- Homme	Slight-----	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
HmB*: Homme-----	Slight-----	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ethan-----	Slight-----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
HnA*: Homme-----	Slight-----	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Onita-----	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Hv----- Hoven	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: ponding, low strength.
La----- Lane	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ma----- Macken	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, ponding, shrink-swell.
Na----- Napa	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.
Oa----- Onita	Moderate: too clayey, wetness, floods.	Severe: floods, shrink-swell.	Severe: floods.	Severe: floods, shrink-swell.	Severe: low strength, floods, frost action.
On*: Onita-----	Moderate: too clayey, wetness, floods.	Severe: floods, shrink-swell.	Severe: floods.	Severe: floods, shrink-swell.	Severe: low strength, floods, frost action.
Tetonka-----	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Pg*. Pits					
Pt*: Prosper-----	Moderate: wetness, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods, frost action.
Tetonka-----	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
TaC----- Talmo	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Slight.
Te----- Tetonka	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.
Wo----- Worthing	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, ponding, frost action.
Wp----- Worthing	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ar, Ax----- Arlo	Severe: floods, wetness, poor filter.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: too sandy, small stones, wetness.
BaB----- Beadle	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
BeE*: Betts-----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ethan-----	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Bn----- Bon	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods.	Good.
Bo----- Bon	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, wetness.	Fair: wetness.
CeC*: Clarno-----	Severe: percs slowly.	Severe: slope.	Slight-----	Slight-----	Good.
Ethan-----	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----	Good.
CnA*: Clarno-----	Severe: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
Ethan-----	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Good.
Prosper-----	Severe: floods, wetness, percs slowly.	Slight-----	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.
CnB*: Clarno-----	Severe: percs slowly.	Moderate: slope, seepage.	Slight-----	Slight-----	Good.
Ethan-----	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Good.
Prosper-----	Severe: floods, wetness, percs slowly.	Slight-----	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CpA*: Clarno-----	Severe: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
Prosper-----	Severe: floods, wetness, percs slowly.	Slight-----	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.
CsA*: Clarno-----	Severe: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
Stickney-----	Severe: percs slowly.	Slight-----	Severe: excess sodium, excess salt.	Slight-----	Poor: hard to pack, excess salt, excess sodium.
Prosper-----	Severe: floods, wetness, percs slowly.	Slight-----	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.
DaB----- Davis	Moderate: percs slowly.	Moderate: slope, seepage.	Slight-----	Slight-----	Good.
DbA*: DeGrey-----	Severe: percs slowly.	Slight-----	Severe: excess sodium.	Slight-----	Poor: hard to pack, excess sodium.
Walke-----	Severe: percs slowly.	Slight-----	Severe: too clayey, excess sodium.	Slight-----	Poor: too clayey, hard to pack, excess sodium.
DeA----- Delmont	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
DlB*: Delmont-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
Enet-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
DmC*: Delmont-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
Talmo-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Do----- Dimo	Severe: floods, wetness, poor filter.	Severe: seepage, wetness, floods.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: too sandy, seepage, small stones.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EaA*: Eakin-----	Severe: percs slowly.	Slight-----	Moderate: too clayey.	Slight-----	Fair: too clayey.
Ethan-----	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Good.
EaB*: Eakin-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
Ethan-----	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Good.
EaC*: Eakin-----	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
Ethan-----	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----	Good.
EdA*: Enet-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Delmont-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
EtD*: Ethan-----	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: slope.
Clarno-----	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Fa----- Farmsworth	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, excess sodium.
HbA*, HbB*: Henkin-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Blendon-----	Slight-----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
HeA*: Highmore-----	Severe: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
Eakin-----	Severe: percs slowly.	Slight-----	Moderate: too clayey.	Slight-----	Fair: too clayey.
HeB*: Highmore-----	Severe: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
Eakin-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HgA*: Highmore-----	Severe: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Good.
Walke-----	Severe: percs slowly.	Slight-----	Severe: too clayey, excess sodium.	Slight-----	Poor: too clayey, hard to pack, excess sodium.
HhB----- Homme	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
HmB*: Homme-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
Ethan-----	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----	Good.
HnA*: Homme-----	Severe: percs slowly.	Slight-----	Moderate: too clayey.	Slight-----	Fair: too clayey.
Onita-----	Severe: percs slowly.	Slight-----	Moderate: too clayey.	Slight-----	Fair: too clayey.
Hv----- Hoven	Severe: percs slowly, ponding.	Slight-----	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding
La----- Lane	Severe: percs slowly.	Slight-----	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
Ma----- Macken	Severe: percs slowly, ponding.	Slight-----	Severe: too clayey, ponding.	Severe: ponding.	Poor: hard to pack, too clayey, ponding.
Na----- Napa	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, hard to pack, wetness.
Oa----- Onita	Severe: floods, wetness, percs slowly.	Moderate: wetness.	Severe: floods.	Severe: floods.	Fair: too clayey.
On*: Onita-----	Severe: floods, wetness, percs slowly.	Moderate: wetness.	Severe: floods.	Severe: floods.	Fair: too clayey.
Tetonka-----	Severe: percs slowly, ponding.	Slight-----	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Pg*. Pits					

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pt*: Prosper-----	Severe: floods, wetness, percs slowly.	Slight-----	Severe: floods.	Severe: floods.	Fair: too clayey, wetness.
Tetanka-----	Severe: percs slowly, ponding.	Slight-----	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
TaC----- Talmo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Te----- Tetanka	Severe: percs slowly, ponding.	Slight-----	Severe: ponding, too clayey.	Severe: ponding.	Poor: ponding, too clayey, hard to pack.
Wo----- Worthing	Severe: percs slowly, ponding.	Slight-----	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Wp----- Worthing	Severe: percs slowly, ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ar, Ax----- Arlo	Poor: wetness.	Probable-----	Probable-----	Poor: area reclaim, wetness.
BaB----- Beadle	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BeE*: Betts-----	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ethan-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bn----- Bon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bo----- Bon	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
CeC*: Clarno-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ethan-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
CnA*, CnB*: Clarno-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ethan-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Prosper-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CpA*: Clarno-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Prosper-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CsA*: Clarno-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Stickney-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Prosper-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
DaB----- Davis	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
DbA*: DeGrey-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DbA*: Walke-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
DeA----- Delmont	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
DlB*: Delmont-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
Enet-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
DmC*: Delmont-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
Talmo-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
Do----- Dimo	Fair: wetness.	Probable-----	Probable-----	Fair: thin layer, small stones.
EaA*, EaB*, EaC*: Eakin-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Ethan-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
EdA*: Enet-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
Delmont-----	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
EtD*: Ethan-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Clarno-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Fa----- Farmsworth	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
HbA*, HbB*: Henkin-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
Blendon-----	Good-----	Probable-----	Improbable: too sandy.	Fair: thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HeA*, HeB*: Highmore-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Eakin-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
HgA*: Highmore-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Walke-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
HhB----- Homme	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
HmB*: Homme-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ethan-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
HnA*: Homine-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Onita-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hv----- Hoven	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
La----- Lane	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ma----- Macken	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Na----- Napa	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.
Oa----- Onita	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
On*: Onita-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Tetonka-----	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pg#. Pits				
Pt#: Prosper-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Tetonka-----	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
TaC----- Talmo	Good-----	Probable-----	Probable-----	Poor: small stones, area reclaim.
Te----- Tetonka	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
Wo----- Worthing	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wp----- Worthing	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ar, Ax----- Arlo	Severe: seepage.	Severe: wetness, seepage.	Floods, frost action, cutbanks cave.	Wetness, floods.	Wetness, too sandy.	Wetness.
BaB----- Beadle	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily	Erodes easily, percs slowly.
BeE*: Betts-----	Severe: slope.	Slight-----	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Ethan-----	Severe: slope.	Slight-----	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
Bn----- Bon	Moderate: seepage.	Moderate: piping.	Deep to water	Floods-----	Favorable-----	Favorable.
Bo----- Bon	Moderate: seepage.	Moderate: piping.	Floods, frost action.	Wetness, floods.	Wetness-----	Favorable.
CeC*: Clarno-----	Moderate: seepage, slope.	Slight-----	Deep to water	Slope-----	Erodes easily	Erodes easily.
Ethan-----	Moderate: seepage, slope.	Slight-----	Deep to water	Slope-----	Erodes easily	Erodes easily.
CnA*: Clarno-----	Moderate: seepage.	Slight-----	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Ethan-----	Moderate: seepage.	Slight-----	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Prosper-----	Slight-----	Slight-----	Deep to water	Floods-----	Erodes easily	Erodes easily.
CnB*: Clarno-----	Moderate: seepage, slope.	Slight-----	Deep to water	Slope-----	Erodes easily	Erodes easily.
Ethan-----	Moderate: seepage, slope.	Slight-----	Deep to water	Slope-----	Erodes easily	Erodes easily.
Prosper-----	Slight-----	Slight-----	Deep to water	Floods-----	Erodes easily	Erodes easily.
CpA*: Clarno-----	Moderate: seepage.	Slight-----	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Prosper-----	Slight-----	Slight-----	Deep to water	Floods-----	Erodes easily	Erodes easily.
CsA*: Clarno-----	Moderate: seepage.	Slight-----	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Stickney-----	Slight-----	Severe: hard to pack, excess salt, excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly, erodes easily.	Excess sodium, erodes easily, percs slowly.
Prosper-----	Slight-----	Slight-----	Deep to water	Floods-----	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
DaB----- Davis	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope-----	Favorable-----	Favorable.
DbA*: DeGrey-----	Slight-----	Severe: hard to pack, excess sodium.	Deep to water	Percs slowly, excess sodium.	Erodes easily	Excess sodium, erodes easily, percs slowly.
Walke-----	Slight-----	Severe: hard to pack, excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly---	Excess sodium, percs slowly.
DeA----- Delmont	Severe: seepage.	Severe: seepage.	Deep to water	Droughty-----	Too sandy-----	Droughty.
DlB*: Delmont-----	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy-----	Droughty.
Enet-----	Severe: seepage.	Severe: seepage.	Deep to water	Slope-----	Too sandy-----	Favorable.
DmC*: Delmont-----	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy-----	Droughty.
Talmo-----	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy-----	Droughty.
Do----- Dimo	Severe: seepage.	Severe: seepage.	Floods, frost action, cutbanks cave.	Wetness, floods.	Wetness, too sandy.	Favorable.
EaA*: Eakin-----	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Ethan-----	Moderate: seepage.	Slight-----	Deep to water	Favorable-----	Erodes easily	Erodes easily.
EaB*, EaC*: Eakin-----	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope-----	Erodes easily	Erodes easily.
Ethan-----	Moderate: seepage, slope.	Slight-----	Deep to water	Slope-----	Erodes easily	Erodes easily.
EdA*: Enet-----	Severe: seepage.	Severe: seepage.	Deep to water	Favorable-----	Too sandy-----	Favorable.
Delmont-----	Severe: seepage.	Severe: seepage.	Deep to water	Droughty-----	Too sandy-----	Droughty.
EtD*: Ethan-----	Severe: slope.	Slight-----	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
Clarno-----	Severe: slope.	Slight-----	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.
Fa----- Farmsworth	Slight-----	Severe: hard to pack, excess salt.	Deep to water	Percs slowly, excess sodium, erodes easily.	Percs slowly, erodes easily.	Excess sodium, erodes easily, percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
HbA*: Henkin-----	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
Blendon-----	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing---	Too sandy, soil blowing.	Favorable.
HbB*: Henkin-----	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
Blendon-----	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing---	Too sandy, soil blowing.	Favorable.
HeA*: Highmore-----	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Eakin-----	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
HeB*: Highmore-----	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope-----	Erodes easily	Erodes easily.
Eakin-----	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope-----	Erodes easily	Erodes easily.
HgA*: Highmore-----	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Walke-----	Slight-----	Severe: hard to pack, excess sodium.	Deep to water	Percs slowly, excess sodium.	Percs slowly---	Excess sodium, percs slowly.
HhB----- Homme	Moderate: slope.	Moderate: piping.	Deep to water	Slope-----	Favorable-----	Favorable.
HmB*: Homme-----	Moderate: slope.	Moderate: piping.	Deep to water	Slope-----	Favorable-----	Favorable.
Ethan-----	Moderate: seepage, slope.	Slight-----	Deep to water	Slope-----	Erodes easily	Erodes easily.
HnA*: Homme-----	Slight-----	Moderate: piping.	Deep to water	Favorable-----	Favorable-----	Favorable.
Onita-----	Slight-----	Moderate: hard to pack.	Deep to water	Favorable-----	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Hv----- Hoven	Slight-----	Severe: hard to pack, ponding, excess sodium.	Percs slowly, ponding, excess salt.	Ponding, percs slowly, excess sodium.	Wetness, percs slowly, erodes easily.	Percs slowly, wetness, excess sodium.
La----- Lane	Slight-----	Moderate: hard to pack.	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Ma----- Macken	Slight-----	Severe: hard to pack, ponding.	Percs slowly, ponding.	Slow intake, percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Na----- Napa	Slight-----	Severe: hard to pack, wetness, excess sodium.	Percs slowly, floods, excess salt.	Wetness, percs slowly, floods.	Wetness, percs slowly.	Wetness, excess sodium, percs slowly.
Oa----- Onita	Slight-----	Moderate: hard to pack.	Floods, frost action.	Wetness, floods.	Erodes easily	Erodes easily.
On*: Onita-----	Slight-----	Moderate: hard to pack.	Floods, frost action.	Wetness, floods.	Erodes easily	Erodes easily.
Tetonka-----	Slight-----	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Pg*. Pits						
Pt*: Prosper-----	Slight-----	Slight-----	Deep to water	Floods-----	Erodes easily	Erodes easily.
Tetonka-----	Slight-----	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
TaC----- Talmo	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy-----	Droughty.
Te----- Tetonka	Slight-----	Severe: ponding, hard to pack.	Percs slowly, ponding, frost action.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Wo, Wp----- Worthing	Slight-----	Severe: hard to pack, ponding.	Ponding, frost action, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly, erodes easily.	Wetness, percs slowly.

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol &lt; means less than; &gt; means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
Ar----- Arlo	0-8	Loam-----	ML, CL	A-4, A-6	0-5	100	95-100	85-100	60-85	30-40	5-15
	8-36	Loam, clay loam	ML, CL	A-4, A-6, A-7	0-5	100	95-100	85-100	60-80	30-45	5-20
	36-60	Gravelly sand, loamy sand, gravelly loamy sand.	GM, SM, GP-GM, SP-SM	A-2, A-1, A-3	0-5	60-100	50-75	40-65	5-35	<25	NP
Ax----- Arlo	0-8	Loam-----	ML, CL	A-4, A-6	0-5	100	95-100	85-100	60-85	30-40	5-15
	8-49	Loam, clay loam	ML, CL	A-4, A-6, A-7	0-5	100	95-100	85-100	60-80	30-45	5-20
	49-60	Gravelly sand, loamy sand, gravelly loamy sand.	GM, SM, GP-GM, SP-SM	A-2, A-1, A-3	0-5	60-100	50-75	40-65	5-35	<25	NP
BaB----- Beadle	0-7	Clay loam-----	CL, ML	A-6, A-7	0-5	95-100	95-100	85-100	65-90	30-50	10-20
	7-30	Clay loam, clay	CL, CH	A-7	0-5	90-100	85-100	75-95	55-95	40-60	15-35
	30-60	Clay loam, clay	CL, CH, ML, MH	A-6, A-7	0-5	90-100	85-100	75-95	55-85	35-55	15-25
BeE*: Betts-----	0-3	Loam-----	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	3-27	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	27-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
Ethan-----	0-8	Loam-----	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-27	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	27-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Bn----- Bon	0-22	Loam-----	CL-ML, CL	A-4, A-6	0	100	95-100	80-95	60-85	25-40	5-15
	22-60	Stratified silty clay loam to fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-95	60-85	25-40	3-15
Bo----- Bon	0-30	Loam-----	CL-ML, CL	A-4, A-6	0	100	90-100	80-95	60-85	25-40	5-15
	30-60	Stratified silty clay loam to fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-95	60-85	25-40	3-15
CeC*: Clarno-----	0-9	Loam-----	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	9-30	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	30-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Ethan-----	0-8	Loam-----	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-27	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	27-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
CnA*, CnB*: Clarno-----	0-9	Loam-----	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	9-30	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	30-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Ethan-----	0-8	Loam-----	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-27	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	27-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
CnA*, CnB*: Prosper-----	<u>In</u> 0-12 12-31 31-35 35-60	Loam----- Clay loam, silty clay loam. Clay loam, loam Clay loam, loam	CL CL, ML CL CL	A-4, A-6 A-6, A-7 A-6, A-7 A-6, A-7	0 0 0-5 0-5	95-100 95-100 95-100 95-100	95-100 95-100 95-100 95-100	85-100 85-100 80-95 80-95	60-90 60-90 55-85 55-85	25-40 35-50 30-50 30-50	8-20 10-25 10-25 10-25
CpA*: Clarno-----	0-9 9-30 30-60	Loam----- Loam, clay loam Loam, clay loam	CL, CL-ML CL CL	A-4, A-6 A-6, A-7 A-6, A-7	0 0-5 0-5	100 95-100 90-100	95-100 90-100 90-100	85-100 80-100 80-100	55-90 55-85 50-80	25-40 30-45 30-45	5-15 10-20 10-20
Prosper-----	0-12 12-31 31-35 35-60	Loam----- Clay loam, silty clay loam. Clay loam, loam Clay loam, loam	CL CL, ML CL CL	A-4, A-6 A-6, A-7 A-6, A-7 A-6, A-7	0 0 0-5 0-5	95-100 95-100 95-100 95-100	95-100 95-100 95-100 95-100	85-100 85-100 80-95 80-95	60-90 60-90 55-85 55-85	25-40 35-50 30-50 30-50	8-20 10-25 10-25 10-25
CsA*: Clarno-----	0-9 9-30 30-60	Loam----- Loam, clay loam Loam, clay loam	CL, CL-ML CL CL	A-4, A-6 A-6, A-7 A-6, A-7	0 0-5 0-5	100 95-100 90-100	95-100 90-100 90-100	85-100 80-100 80-100	55-90 55-85 50-80	25-40 30-45 30-45	5-15 10-20 10-20
Stickney-----	0-11 11-25 25-60	Loam, silt loam Clay loam, silty clay loam, clay. Clay loam, loam	CL CL, CH, MH CL, CH, MH, ML	A-4, A-6 A-7 A-6, A-7	0 0 0-5	95-100 95-100 95-100	95-100 95-100 90-100	85-100 85-100 80-100	60-90 65-95 55-90	30-40 40-60 35-60	8-15 14-34 10-30
Prosper-----	0-12 12-31 31-35 35-60	Loam----- Clay loam, silty clay loam. Clay loam, loam Clay loam, loam	CL CL, ML CL CL	A-4, A-6 A-6, A-7 A-6, A-7 A-6, A-7	0 0 0-5 0-5	95-100 95-100 95-100 95-100	95-100 95-100 95-100 95-100	85-100 85-100 80-95 80-95	60-90 60-90 55-85 55-85	25-40 35-50 30-50 30-50	8-20 10-25 10-25 10-25
DaB----- Davis	0-17 17-36 36-60	Silt loam----- Loam, silt loam, clay loam. Loam, clay loam, silt loam.	CL CL CL	A-6, A-7 A-6, A-7 A-6, A-7	0 0 0	100 100 100	90-100 90-100 95-100	80-100 80-100 85-100	60-85 60-85 55-90	30-45 30-45 30-45	10-20 10-20 10-20
DbA*: DeGrey-----	0-8 8-20 20-40 40-60	Silt loam----- Silty clay, silty clay loam. Silty clay, silty clay loam. Loam, clay loam	CL, CL-ML CL, CH CL, CH CL, CH, MH, ML	A-4, A-6 A-7 A-7 A-6, A-7	0 0 0 0	100 100 100 100	100 100 95-100 95-100	90-100 90-100 90-100 90-100	70-95 80-100 80-100 80-100	25-40 40-65 40-65 30-65	5-15 15-35 15-35 12-32
Walke-----	0-11 11-32 32-60	Silt loam----- Silty clay loam, silty clay. Clay loam, clay	CL, CL-ML, ML CL, CH CL, CH, MH	A-6, A-4 A-7 A-7	0 0 0	100 100 95-100	100 100 95-100	95-100 85-100 90-100	80-100 40-55 70-90	25-40 40-55 40-65	3-15 15-28 15-30
DeA----- Delmont	0-7 7-17 17-60	Loam----- Loam, fine sandy loam, sandy loam. Gravelly sand, gravelly loamy sand.	CL SC, CL, CL-ML, SM-SC SM, SW-SM, SM-SC, SW	A-6, A-4 A-4, A-6 A-1, A-2	0 0 0-5	90-100 80-100 60-100	90-100 70-100 40-70	80-95 50-100 15-50	60-75 35-70 3-30	28-40 20-40 <25	8-20 5-18 NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
D1B*: Delmont-----	0-7	Loam-----	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	7-17	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	17-60	Gravelly sand, gravelly loamy sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-70	15-50	3-30	<25	NP-5
Enet-----	0-6	Loam-----	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	6-24	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	24-29	Loam, fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	85-95	60-95	40-75	20-40	3-15
	29-60	Gravelly loamy sand, gravelly sand.	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-95	45-85	10-60	0-15	<25	NP-5
DmC*: Delmont-----	0-7	Loam-----	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	7-17	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	17-60	Gravelly sand, gravelly loamy sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-70	15-50	3-30	<25	NP-5
Talmo-----	0-6	Loam-----	ML, CL	A-4, A-6	0-5	95-100	90-100	85-100	55-75	30-40	5-15
	6-60	Gravelly sand, very gravelly sand, gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	0-10	40-95	30-65	15-35	0-35	<25	NP-5
Do----- Dimo	0-7	Loam-----	CL	A-4, A-6	0	100	100	85-100	60-75	30-40	8-15
	7-24	Clay loam, loam	CL	A-6, A-7	0	90-100	85-100	85-95	50-80	35-45	12-20
	24-28	Sandy loam-----	SM, SM-SC	A-4	0	90-100	80-100	50-80	35-50	20-30	NP-5
	28-60	Gravelly sand-----	SM, SP-SM, SW-SM, SM-SC	A-1, A-2, A-3	0-5	60-90	40-70	20-60	5-30	<25	NP-5
EaA*, EaB* EaC*: Eakin-----	0-7	Silt loam-----	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	7-33	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	95-100	95-100	80-100	35-50	10-25
	33-60	Clay loam, loam, clay.	CL, CH	A-7	0	95-100	85-100	75-100	60-95	40-70	16-42
Ethan-----	0-8	Loam-----	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-27	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	27-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
EdA*: Enet-----	0-6	Loam-----	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	6-24	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	24-29	Loam, fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	85-95	60-95	40-75	20-40	3-15
	29-60	Gravelly loamy sand, gravelly sand.	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-95	45-85	10-60	0-15	<25	NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	<u>Yn</u>				<u>Pct</u>					<u>Pct</u>	
EdA*: Delmont-----	0-7	Loam-----	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	7-17	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	17-60	Gravelly sand, gravelly loamy sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-70	15-50	3-30	<25	NP-5
EtD*: Ethan-----	0-8	Loam-----	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-27	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	27-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Clarno-----	0-9	Loam-----	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	9-30	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	30-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Fa----- Farmsworth	0-5	Silt loam-----	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	70-95	25-40	3-15
	5-24	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	85-95	50-70	20-40
	24-60	Clay, silty clay, clay loam.	CH, MH	A-7	0	95-100	95-100	85-100	80-95	50-65	20-35
HbA*, HbB*: Henkin-----	0-12	Fine sandy loam	SM, SC, ML, CL	A-2, A-4	0-5	90-100	80-100	65-100	30-55	15-30	NP-10
	12-26	Loam, sandy loam, fine sandy loam.	SM, SC, ML, CL	A-2, A-4	0-5	90-100	80-100	65-100	20-55	15-30	NP-10
	26-60	Stratified fine sand to clay loam.	SM, SC	A-2, A-4, A-1, A-3	0-5	90-100	80-100	35-95	5-50	15-35	NP-10
Blendon-----	0-13	Fine sandy loam	SM	A-4	0	100	90-100	60-100	35-50	20-30	NP-5
	13-34	Fine sandy loam, sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	85-100	60-100	35-60	20-33	NP-10
	34-60	Fine sandy loam, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-4	0	85-100	65-100	50-100	10-45	<30	NP-5
HeA*, HeB*: Highmore-----	0-9	Silt loam-----	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	9-19	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	15-25
	19-52	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	100	95-100	90-100	85-100	30-45	10-22
	52-60	Clay loam, loam	CL, CH	A-7	0-5	95-100	85-100	75-100	60-95	40-70	16-42
Eakin-----	0-7	Silt loam-----	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	7-33	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	95-100	95-100	80-100	35-50	10-25
	33-60	Clay loam, loam, clay.	CL, CH	A-7	0	95-100	85-100	75-100	60-95	40-70	16-42
HgA*: Highmore-----	0-9	Silt loam-----	ML, CL	A-4, A-6, A-7	0	100	95-100	95-100	90-100	30-45	5-20
	9-19	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	15-25
	19-52	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	100	95-100	90-100	85-100	30-45	10-22
	52-60	Clay loam, loam	CL, CH	A-7	0-5	95-100	85-100	75-100	60-95	40-70	16-42
Walke-----	0-11	Silt loam-----	CL, CL-ML, ML	A-6, A-4	0	100	100	95-100	80-100	25-40	3-15
	11-32	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-28
	32-60	Clay loam, clay	CL, CH, MH	A-7	0	95-100	95-100	90-100	70-90	40-65	15-30

See footnote at end of table.

TABLE '3.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
HhB----- Homme	0-10	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-95	35-45	15-25
	10-28	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	85-95	40-55	15-30
	28-46	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-90	35-55	15-30
	46-60	Clay loam, loam	CL	A-6	0-5	95-100	90-100	85-100	60-80	30-40	10-20
HmB*: Homme-----	0-10	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-95	35-45	15-25
	10-28	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	85-95	40-55	15-30
	28-46	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-90	35-55	15-30
	46-60	Clay loam, loam	CL	A-6	0-5	95-100	90-100	85-100	60-80	30-40	10-20
Ethan-----	0-8	Loam-----	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	30-40	8-15
	8-27	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	27-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
HnA*: Homme-----	0-10	Silty clay loam	CL	A-6, A-7	0	100	95-100	95-100	85-95	35-45	15-25
	10-28	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	85-95	40-55	15-30
	28-46	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	80-90	35-55	15-30
	46-60	Clay loam, loam	CL	A-6	0-5	95-100	90-100	85-100	60-80	30-40	10-20
Onita-----	0-15	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	10-25
	15-32	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	32-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
Hv----- Hoven	0-5	Silt loam-----	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
	5-22	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	22-32	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-40
	32-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
La----- Lane	0-10	Silty clay loam	CL, MH, ML, CH	A-6, A-7	0	100	100	95-100	75-100	35-55	11-25
	10-26	Silty clay, clay, silty clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	90-100	75-100	45-65	15-35
	26-60	Silty clay, silty clay loam, clay loam.	CL, CH	A-7, A-6	0	100	95-100	85-100	65-100	35-65	15-40
Ma----- Macken	0-3	Silty clay-----	CH, MH	A-7	0	100	100	95-100	85-100	50-75	20-45
	3-25	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	85-100	50-80	20-45
	25-60	Silty clay, silty clay loam, clay.	CH, MH	A-7	0	100	100	95-100	85-100	50-80	20-45
Na----- Napa	0-1	Silt loam-----	ML, CL	A-4, A-6	0	100	100	100	90-100	30-40	5-15
	1-38	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	90-100	50-80	20-45
	38-60	Silty clay, clay, silty clay loam.	CL, CH, MH	A-7	0	100	100	95-100	90-100	40-75	15-40

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
Oa----- Onita	0-15	Silt loam-----	CL, ML	A-4, A-6, A-7	0	100	95-100	90-100	70-100	30-45	7-20
	15-32	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	32-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
On*: Onita-----	0-15	Silt loam-----	CL, ML	A-4, A-6, A-7	0	100	95-100	90-100	70-100	30-45	7-20
	15-32	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	32-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
Tetonka-----	0-11	Silt loam-----	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	11-13	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	13-31	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	31-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
Pg*. Pits											
Pt*: Prosper-----	0-12	Loam-----	CL	A-4, A-6	0	95-100	95-100	85-100	60-90	25-40	8-20
	12-31	Clay loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	85-100	60-90	35-50	10-25
	31-35	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-85	30-50	10-25
	35-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	80-95	55-85	30-50	10-25
Tetonka-----	0-11	Silt loam-----	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	11-13	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	13-31	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	31-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
TaC----- Talmo	0-8	Gravelly sandy loam.	ML, CL, SM< SC	A-4, A-6	0-5	90-100	60-80	50-75	35-60	25-40	3-15
	8-60	Gravelly sand, very gravelly sand, gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	0-10	40-95	30-65	15-35	0-35	<25	NP-5
Te----- Tetonka	0-11	Silt loam-----	ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	27-50	5-20
	11-13	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	30-50	10-25
	13-31	Clay, silty clay, silty clay loam.	CL, CH, MH, ML	A-7	0	95-100	95-100	85-100	65-100	40-70	15-35
	31-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0	95-100	95-100	80-100	55-95	30-60	11-30
Wo, Wp----- Worthing	0-8	Silty clay loam	CL	A-7	0	100	100	95-100	85-95	42-50	17-22
	8-43	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	85-100	50-70	22-35
	43-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-95	40-65	15-30

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
		In/hr	In/in	pH	mmhos/cm		K	T		
Ar----- Arlo	0-8 8-36 36-60	0.6-2.0 0.6-2.0 6.0-20	0.18-0.22 0.15-0.19 0.03-0.06	6.6-8.4 7.4-8.4 7.4-8.4	<2 <2 <4	Moderate---- Moderate---- Low-----	0.28 0.28 0.10	4	4L	2-4
Ax----- Arlo	0-8 8-49 49-60	0.6-2.0 0.6-2.0 6.0-20	0.18-0.22 0.15-0.19 0.03-0.06	6.6-8.4 7.4-8.4 7.4-8.4	<2 <2 <4	Moderate---- Moderate---- Low-----	0.28 0.28 0.10	4	4L	2-4
BaB----- Beadle	0-7 7-30 30-60	0.6-2.0 0.06-0.6 0.2-0.6	0.19-0.22 0.13-0.19 0.13-0.17	6.1-7.3 6.6-8.4 7.4-8.4	<2 <2 2-4	Moderate---- High----- Moderate----	0.28 0.28 0.37	5	7	2-4
BeE*: Betts-----	0-3 3-27 27-60	0.6-2.0 0.6-2.0 0.2-0.6	0.16-0.18 0.17-0.20 0.17-0.20	6.6-8.4 7.4-8.4 7.4-8.4	<2 <2 2-8	Moderate---- Moderate---- Moderate----	0.28 0.37 0.37	5	4L	1-3
Ethan-----	0-8 8-27 27-60	0.6-2.0 0.6-2.0 0.2-2.0	0.18-0.20 0.16-0.20 0.16-0.20	6.1-7.8 7.4-8.4 7.4-9.0	<2 <2 2-8	Moderate---- Moderate---- Moderate----	0.28 0.37 0.37	5	6	1-3
Bn----- Bon	0-22 22-60	0.6-2.0 0.6-2.0	0.19-0.22 0.13-0.17	6.6-8.4 7.4-8.4	<2 <2	Low----- Low-----	0.24 0.32	5	6	4-6
Bo----- Bon	0-30 30-60	0.6-2.0 0.6-2.0	0.19-0.22 0.13-0.17	6.6-8.4 7.4-8.4	<2 <2	Low----- Low-----	0.24 0.32	5	6	4-6
CeC*: Clarno-----	0-9 9-30 30-60	0.6-2.0 0.6-2.0 0.2-0.6	0.18-0.20 0.16-0.20 0.16-0.20	6.1-7.3 6.6-8.4 7.4-9.0	<2 <2 2-8	Low----- Moderate---- Moderate----	0.28 0.37 0.37	5	6	2-4
Ethan-----	0-8 8-27 27-60	0.6-2.0 0.6-2.0 0.2-2.0	0.18-0.20 0.16-0.20 0.16-0.20	6.1-7.8 7.4-8.4 7.4-9.0	<2 <2 2-8	Moderate---- Moderate---- Moderate----	0.28 0.37 0.37	5	6	1-3
CnA*, CnB*: Clarno-----	0-9 9-30 30-60	0.6-2.0 0.6-2.0 0.2-0.6	0.18-0.20 0.16-0.20 0.16-0.20	6.1-7.3 6.6-8.4 7.4-9.0	<2 <2 2-8	Low----- Moderate---- Moderate----	0.28 0.37 0.37	5	6	2-4
Ethan-----	0-8 8-27 27-60	0.6-2.0 0.6-2.0 0.2-2.0	0.18-0.20 0.16-0.20 0.16-0.20	6.1-7.8 7.4-8.4 7.4-9.0	<2 <2 2-8	Moderate---- Moderate---- Moderate----	0.28 0.37 0.37	5	6	1-3
Prosper-----	0-12 12-31 31-35 35-60	0.6-2.0 0.6-2.0 0.6-2.0 0.2-0.6	0.18-0.22 0.19-0.22 0.17-0.20 0.17-0.20	5.6-7.8 6.6-7.8 7.4-8.4 7.4-8.4	<2 <2 2-4 2-8	Moderate---- Moderate---- Moderate---- Moderate----	0.28 0.28 0.28 0.37	5	6	4-6
CpA*: Clarno-----	0-9 9-30 30-60	0.6-2.0 0.6-2.0 0.2-0.6	0.18-0.20 0.16-0.20 0.16-0.20	6.1-7.3 6.6-8.4 7.4-9.0	<2 <2 2-8	Low----- Moderate---- Moderate----	0.28 0.37 0.37	5	6	2-4
Prosper-----	0-12 12-31 31-35 35-60	0.6-2.0 0.6-2.0 0.6-2.0 0.2-0.6	0.18-0.22 0.19-0.22 0.17-0.20 0.17-0.20	5.6-7.8 6.6-7.8 7.4-8.4 7.4-8.4	<2 <2 2-4 2-8	Moderate---- Moderate---- Moderate---- Moderate----	0.28 0.28 0.28 0.37	5	6	4-6

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
CsA*:										
Clarno-----	0-9	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-----	0.28	5	6	2-4
	9-30	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate----	0.37			
	30-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			
Stickney-----	0-11	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate----	0.37	3	6	2-4
	11-25	0.06-0.2	0.16-0.19	6.1-7.8	4-16	High-----	0.37			
	25-60	0.06-0.6	0.14-0.18	7.4-8.4	>4	High-----	0.37			
Prosper-----	0-12	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate----	0.28	5	6	4-6
	12-31	0.6-2.0	0.19-0.22	6.6-7.8	<2	Moderate----	0.28			
	31-35	0.6-2.0	0.17-0.20	7.4-8.4	2-4	Moderate----	0.28			
	35-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate----	0.37			
DaB-----	0-17	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate----	0.24	5	6	4-6
Davis-----	17-36	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate----	0.24			
	36-60	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate----	0.24			
DbA*:										
DeGrey-----	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low-----	0.37	3	6	2-4
	8-20	<0.2	0.14-0.19	6.6-8.4	2-8	High-----	0.37			
	20-40	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High-----	0.37			
	40-60	0.2-0.6	0.14-0.18	7.9-9.0	4-16	Moderate----	0.37			
Walke-----	0-11	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	6	1-3
	11-32	0.06-0.6	0.11-0.19	6.6-8.4	<4	High-----	0.32			
	32-60	0.06-0.6	0.17-0.20	7.4-8.4	2-8	Moderate----	0.32			
DeA-----	0-7	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-----	0.28	3	6	2-4
Delmont-----	7-17	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low-----	0.28			
	17-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
DlB*:										
Delmont-----	0-7	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-----	0.28	3	6	2-4
	7-17	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low-----	0.28			
	17-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
Enet-----	0-6	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low-----	0.28	4	6	2-4
	6-24	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low-----	0.28			
	24-29	0.6-6.0	0.11-0.20	6.6-8.4	<2	Low-----	0.28			
	29-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
DmC*:										
Delmont-----	0-7	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-----	0.28	3	6	2-4
	7-17	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low-----	0.28			
	17-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
Talmo-----	0-6	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-----	0.20	2	6	2-4
	6-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
Do-----	0-7	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate----	0.24	4	6	4-6
Dimo-----	7-24	0.6-2.0	0.16-0.20	6.1-7.8	<2	Moderate----	0.24			
	24-28	2.0-6.0	0.08-0.12	7.4-8.4	<2	Low-----	0.20			
	28-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
EaA*, EaB*, EaC*:										
Eakin-----	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	6	2-4
	7-33	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate----	0.43			
	33-60	0.2-0.6	0.16-0.20	7.4-9.0	<4	Moderate----	0.43			
Ethan-----	0-8	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate----	0.28	5	6	1-3
	8-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate----	0.37			
	27-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			
EdA*:										
Enet-----	0-6	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low-----	0.28	4	6	2-4
	6-24	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low-----	0.28			
	24-29	0.6-6.0	0.11-0.20	6.6-8.4	<2	Low-----	0.28			
	29-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
EdA*:										
Delmont-----	0-7	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-----	0.28	3	6	2-4
	7-17	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low-----	0.28			
	17-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
EdD*:										
Ethan-----	0-8	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate----	0.28	5	6	1-3
	8-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate----	0.37			
	27-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			
Clarno-----	0-9	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-----	0.28	5	6	2-4
	9-30	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate----	0.37			
	30-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			
Fa-----	0-5	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate----	0.37	3	6	2-4
Farmsworth	5-24	<0.2	0.10-0.14	6.1-7.8	4-16	High-----	0.37			
	24-60	0.06-0.2	0.08-0.12	7.4-9.0	4-16	High-----	0.37			
HbA*, HbB*:										
Henkin-----	0-12	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low-----	0.20	5	3	2-4
	12-26	2.0-6.0	0.09-0.18	6.1-8.4	<2	Low-----	0.20			
	26-60	0.6-6.0	0.08-0.16	6.1-8.4	<2	Low-----	0.20			
Blendon-----	0-13	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low-----	0.20	5	3	2-3
	13-34	0.6-6.0	0.11-0.18	6.1-7.3	<2	Low-----	0.20			
	34-60	2.0-6.0	0.08-0.15	6.6-8.4	<2	Low-----	0.20			
HeA*, HeB*:										
Highmore-----	0-9	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low-----	0.32	5	6	2-4
	9-19	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate----	0.43			
	19-52	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate----	0.43			
	52-60	0.2-0.6	0.16-0.20	7.4-8.4	2-4	Moderate----	0.43			
Eakin-----	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	6	2-4
	7-33	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate----	0.43			
	33-60	0.2-0.6	0.16-0.20	7.4-9.0	<4	Moderate----	0.43			
HgA*:										
Highmore-----	0-9	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low-----	0.32	5	6	2-4
	9-19	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate----	0.43			
	19-52	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate----	0.43			
	52-60	0.2-0.6	0.16-0.20	7.4-8.4	2-4	Moderate----	0.43			
Walke-----	0-11	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	6	1-3
	11-32	0.06-0.6	0.11-0.19	6.6-8.4	<4	High-----	0.32			
	32-60	0.06-0.6	0.17-0.20	7.4-8.4	2-8	Moderate----	0.32			
HhB-----	0-10	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	7	2-4
Homme	10-28	0.2-0.6	0.11-0.18	6.1-7.8	<2	High-----	0.32			
	28-46	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate----	0.32			
	46-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate----	0.32			
HmB*:										
Homme-----	0-10	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	7	2-4
	10-28	0.2-0.6	0.11-0.18	6.1-7.8	<2	High-----	0.32			
	28-46	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate----	0.32			
	46-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate----	0.32			
Ethan-----	0-8	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate----	0.28	5	6	1-3
	8-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate----	0.37			
	27-60	0.2-2.0	0.16-0.20	7.4-9.0	2-8	Moderate----	0.37			
HnA*:										
Homme-----	0-10	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	7	2-4
	10-28	0.2-0.6	0.11-0.18	6.1-7.8	<2	High-----	0.32			
	28-46	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate----	0.32			
	46-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate----	0.32			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
HnA*: Onita-----	0-15	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.28	5	7	4-6
	15-32	0.2-0.6	0.11-0.17	6.1-7.3	<2	High-----	0.28			
	32-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate----	0.43			
Hv----- Hoven	0-5	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.37	1	8	2-4
	5-22	<0.06	0.10-0.19	6.1-7.8	4-16	High-----	0.37			
	22-32	<0.06	0.10-0.19	7.4-8.4	4-16	High-----	0.37			
	32-60	<0.2	0.08-0.17	7.4-9.0	4-16	High-----	0.37			
La----- Lane	0-10	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.28	5	7	4-6
	10-26	0.06-0.6	0.13-0.19	6.6-7.8	<2	High-----	0.28			
	26-60	0.06-0.6	0.11-0.20	7.4-8.4	<4	High-----	0.37			
Ma----- Macken	0-3	0.2-0.6	0.19-0.22	6.1-7.3	<2	High-----	0.37	5	8	3-6
	3-25	0.06-0.2	0.10-0.18	6.6-8.4	<2	High-----	0.37			
	25-60	0.06-0.2	0.08-0.17	7.4-8.4	<2	High-----	0.37			
Na----- Napa	0-1	0.6-2.0	0.16-0.18	6.6-8.4	<2	Low-----	0.28	3	6	2-5
	1-38	<0.06	0.13-0.18	7.4-9.0	4-16	High-----	0.28			
	38-60	<0.06	0.11-0.16	7.4-9.0	2-8	High-----	0.28			
Oa----- Onita	0-15	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.28	5	6	4-6
	15-32	0.2-0.6	0.11-0.17	6.1-7.3	<2	High-----	0.43			
	32-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate----	0.43			
On*: Onita-----	0-15	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.28	5	6	4-6
	15-32	0.2-0.6	0.11-0.17	6.1-7.3	<2	High-----	0.43			
	32-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate----	0.43			
Tetonka-----	0-11	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.24	3	6	2-4
	11-13	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate----	0.32			
	13-31	<0.2	0.13-0.19	6.1-7.8	<2	High-----	0.32			
	31-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High-----	0.32			
Pg*. Pits										
Pt*: Prosper-----	0-12	0.6-2.0	0.18-0.22	5.6-7.8	<2	Moderate----	0.28	5	6	4-6
	12-31	0.6-2.0	0.19-0.22	6.6-7.8	<2	Moderate----	0.28			
	31-35	0.6-2.0	0.17-0.20	7.4-8.4	2-4	Moderate----	0.28			
	35-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate----	0.37			
Tetonka-----	0-11	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.24	3	6	2-4
	11-13	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate----	0.32			
	13-31	<0.2	0.13-0.19	6.1-7.8	<2	High-----	0.32			
	31-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High-----	0.32			
TaC----- Talmo	0-8	0.6-2.0	0.11-0.15	6.6-7.8	<2	Low-----	0.20	2	8	1-2
	8-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-----	0.10			
Te----- Tetonka	0-11	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate----	0.24	3	6	2-4
	11-13	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate----	0.32			
	13-31	<0.2	0.13-0.19	6.1-7.8	<2	High-----	0.32			
	31-60	0.06-0.6	0.11-0.17	6.6-8.4	2-8	High-----	0.32			
Wo, Wp----- Worthing	0-8	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate----	0.37	5	7	3-5
	8-43	0.06-0.2	0.13-0.18	6.1-7.3	<2	High-----	0.37			
	43-60	0.2-0.6	0.11-0.17	7.4-8.4	2-8	High-----	0.37			

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the text explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
Ar----- Arlo	B	Occasional	Brief-----	Mar-Aug	0-2.0	Apparent	Oct-Jun	High-----	High-----	Moderate.
Ax----- Arlo	B	Frequent----	Brief-----	Mar-Aug	+5-2.0	Apparent	Oct-Jun	High-----	High-----	Moderate.
BaB----- Beadle	C	None-----	---	---	>6.0	---	---	Low-----	High-----	Moderate.
BeE*: Betts-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Ethan-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Bn----- Bon	B	Occasional	Brief-----	Apr-Oct	>6.0	---	---	Moderate	Moderate	Low.
Bo----- Bon	B	Frequent----	Brief-----	Apr-Oct	2.0-6.0	Apparent	Oct-Jul	High-----	Moderate	Low.
CeC*: Clarno-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Ethan-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
CnA*, CnB*: Clarno-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Ethan-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Prosper-----	B	Occasional	Very brief	Oct-Jun	3 0-6.0	Perched	Oct-Jun	High-----	High-----	Moderate.
CpA*: Clarno-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Prosper-----	B	Occasional	Very brief	Oct-Jun	3.0-6.0	Perched	Oct-Jun	High-----	High-----	Moderate.
CsA*: Clarno-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Stickney-----	C	None-----	---	---	>6.0	---	---	Moderate	High-----	High.
Prosper-----	B	Occasional	Very brief	Oct-Jun	3.0-6.0	Perched	Oct-Jun	High-----	High-----	Moderate.
DaB----- Davis	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Low.
DbA*: DeGrey-----	D	None-----	---	---	>6.0	---	---	Low-----	High-----	Moderate.
Walke-----	C	None-----	---	---	>6.0	---	---	Low-----	High-----	Moderate.
DeA----- Delmont	B	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.
DlB*: Delmont-----	B	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.
Enet-----	B	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.
DmC*: Delmont-----	B	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.
Talmo-----	A	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months		Uncoated steel	Concrete
Do----- Dimo	B	Occasional	Very brief	Mar-Oct	2.0-6.0	Apparent	Oct-Jun	High-----	High-----	Low.
EaA*, EaB*, EaC*: Eakin-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Ethan-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
EdA*: Enet-----	B	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.
Delmont-----	B	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.
EtD*: Ethan-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Clarno-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Fa----- Farmsworth	D	Rare-----	---	---	3.0-6.0	Apparent	Apr-Jun	Moderate	High-----	Moderate.
HbA*, HbB*: Henkin-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Low.
Blendon-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Low.
HeA*, HeB*: Highmore-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Low.
Eakin-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Moderate.
HgA*: Highmore-----	B	None-----	---	---	>6.0	---	---	Moderate	High-----	Low.
Walke-----	C	None-----	---	---	>6.0	---	---	Low-----	High-----	Moderate.
HhB----- Homme	C	None-----	---	---	>6.0	---	---	Low-----	High-----	Low.
HmB*: Homme-----	C	None-----	---	---	>6.0	---	---	Low-----	High-----	Low.
Ethan-----	B	None-----	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
HnA*: Homme-----	C	None-----	---	---	>6.0	---	---	Low-----	High-----	Low.
Onita-----	C	None-----	---	---	>6.0	---	---	Moderate	High-----	Low.
Hv----- Hoven	D	None-----	---	---	+1-1.5	Perched	Mar-Jul	Moderate	High-----	Moderate.
La----- Lane	C	None-----	---	---	>6.0	---	---	Low-----	High-----	Moderate.
Ma----- Macken	D	None-----	---	---	+1.5-1.0	Perched	Apr-Jul	Moderate	High-----	Moderate.
Na----- Napa	D	Occasional	Brief-----	Apr-Jun	0-1.0	Apparent	Nov-Jul	Moderate	High-----	Moderate.
Oa----- Onita	C	Occasional	Brief-----	Mar-Oct	2.5-6.0	Perched	Oct-Jun	High-----	High-----	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months		Uncoated steel	Concrete
On*: Onita-----	C	Occasional	Brief-----	Mar-Oct	2.5-6.0	Perched	Oct-Jun	High-----	High-----	Low.
Tetonka-----	C/D	None-----	---	---	+1-1.0	Perched	Jan-Dec	High-----	High-----	Moderate.
Pg*: Pits										
Pt*: Prosper-----	B	Occasional	Very brief	Oct-Jun	3.0-6.0	Perched	Oct-Jun	High-----	High-----	Moderate.
Tetonka-----	C/D	None-----	---	---	+1-1.0	Perched	Jan-Dec	High-----	High-----	Moderate.
TaC-----	A	None-----	---	---	>6.0	---	---	Low-----	Moderate	Low.
Talmo										
Te-----	C/D	None-----	---	---	+1-1.0	Perched	Jan-Dec	High-----	High-----	Moderate.
Tetonka										
Wo-----	D	None-----	---	---	+1-1.0	Perched	Jan-Dec	High-----	High-----	Moderate.
Worthing										
Wp-----	D	None-----	---	---	+3-0.5	Perched	Jan-Dec	High-----	High-----	High.
Worthing										

\* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Arlo-----	Fine-loamy over sandy or sandy-skeletal, mesic Typic Calciaquolls
Beadle-----	Fine, montmorillonitic, mesic Typic Argiustolls
Betts-----	Fine-loamy, mixed (calcareous), mesic Typic Ustorthents
Blendon-----	Coarse-loamy, mixed, mesic Pachic Haplustolls
Bon-----	Fine-loamy, mixed, mesic Cumulic Haplustolls
Clarno-----	Fine-loamy, mixed, mesic Typic Haplustolls
Davis-----	Fine-loamy, mixed, mesic Pachic Haplustolls
DeGrey-----	Fine, montmorillonitic, mesic Typic Natrustolls
Delmont-----	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Dimo-----	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Eakin-----	Fine-silty, mixed, mesic Typic Argiustolls
Enet-----	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Ethan-----	Fine-loamy, mixed, mesic Entic Haplustolls
Farmsworth-----	Fine, montmorillonitic, mesic Typic Natrustolls
Henkin-----	Coarse-loamy, mixed, mesic Udic Haplustolls
Highmore-----	Fine-silty, mixed, mesic Typic Argiustolls
Homme-----	Fine-silty, mixed, mesic Typic Haplustolls
Hoven-----	Fine, montmorillonitic, mesic Typic Natraquolls
Lane-----	Fine, montmorillonitic, mesic Pachic Argiustolls
Macken-----	Fine, montmorillonitic, mesic Vertic Haplaquolls
Napa-----	Fine, montmorillonitic, mesic Typic Natraquolls
Onita-----	Fine, montmorillonitic, mesic Pachic Argiustolls
Prosper-----	Fine-loamy, mixed, mesic Pachic Argiustolls
Stickney-----	Fine, montmorillonitic, mesic Glossic Natrustolls
Talmo-----	Sandy-skeletal, mixed, mesic Udorthentic Haplustolls
Tetonka-----	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Walke-----	Fine, montmorillonitic, mesic Glossic Natrustolls
Worthing-----	Fine, montmorillonitic, mesic Typic Argiaquolls



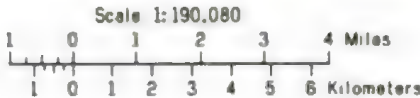
# NRCS Accessibility Statement

---

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at [ServiceDesk-FTC@ftc.usda.gov](mailto:ServiceDesk-FTC@ftc.usda.gov). For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

**GENERAL SOIL MAP**  
**DOUGLAS COUNTY, SOUTH DAKOTA**



**SOIL LEGEND\***

NEARLY LEVEL TO GENTLY ROLLING, SILTY AND LOAMY SOILS  
ON UPLANDS AND IN UPLAND SWALES

- 1 Eakin-Highmore-Ethan association: Well drained, nearly level to gently rolling, silty and loamy soils on uplands
- 2 Homme-Onita-Ethan association: Well drained and moderately well drained, nearly level to gently rolling, silty and loamy soils on uplands and in upland swales
- 3 Highmore-Walke association: Well drained, nearly level to undulating, silty soils on uplands

NEARLY LEVEL TO ROLLING, LOAMY SOILS ON UPLANDS AND  
IN UPLAND SWALES

- 4 Clarno-Ethan-Prosper association: Well drained and moderately well drained, nearly level to rolling, loamy soils on uplands and in upland swales
- 5 Clarno-Prosper-Stickney association: Well drained and moderately well drained, nearly level, loamy soils on uplands and in upland swales
- 6 Clarno-Prosper association: Well drained and moderately well drained, nearly level, loamy soils on uplands and in upland swales

NEARLY LEVEL TO GENTLY ROLLING, LOAMY SOILS ON  
UPLANDS AND TERRACES

- 7 Henkin-Blendon association: Well drained, nearly level to undulating, loamy soils on uplands and terraces
- 8 Delmont-Eneet-Talmo association: Well drained to excessively drained, nearly level to gently rolling, loamy soils on uplands and terraces

NEARLY LEVEL TO STEEP, LOAMY SOILS ON UPLANDS AND  
FLOOD PLAINS

- 9 Ethan-Bon-Betts association: Well drained and moderately well drained, nearly level to steep, loamy soils on uplands and flood plains

NEARLY LEVEL, LOAMY AND SILTY SOILS ON FLOOD PLAINS,  
TERRACES, AND FOOT SLOPES

- 10 Bon-Farmsworth-Napa association: Moderately well drained to poorly drained, nearly level, loamy and silty soils on flood plains
- 11 Lane-Bon association: Well drained and moderately well drained, nearly level, silty and loamy soils on stream terraces, foot slopes, and flood plains

\*The texture terms in the descriptive headings refer to the  
surface layer of the major soils in each association.

Compiled 1980

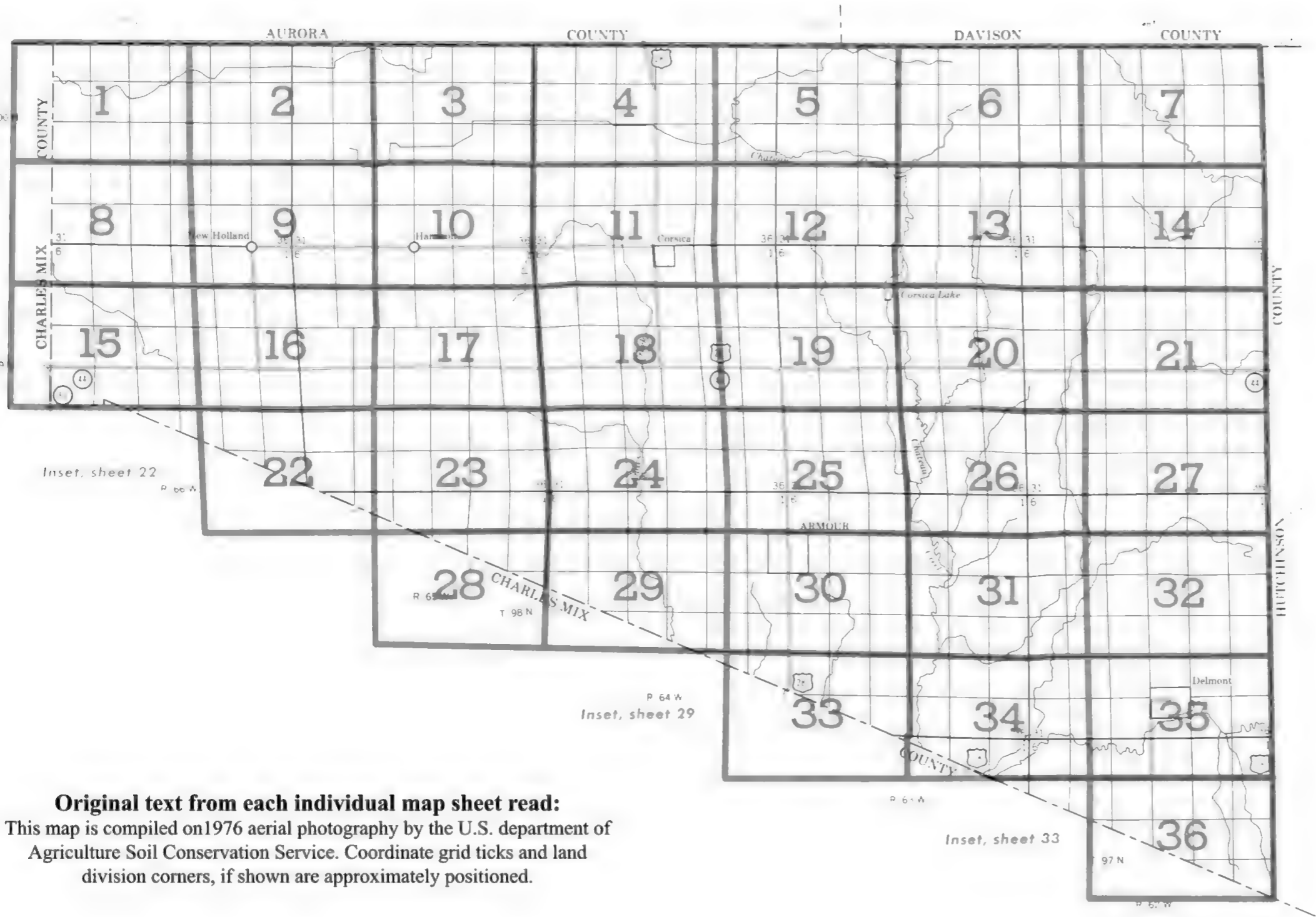
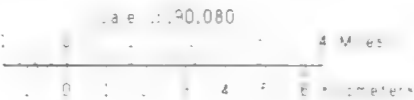
SECTIONALIZED  
TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of  
more than one kind of soil. The map is thus  
meant for general planning rather than a basis  
for decisions on the use of specific tracts.



INDEX TO MAP SHEETS  
DOUGLAS COUNTY, SOUTH DAKOTA



**Original text from each individual map sheet read:**  
This map is compiled on 1976 aerial photography by the U.S. department of Agriculture Soil Conservation Service. Coordinate grid ticks and land division corners, if shown are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL  
SYMBOLS LEGEND

SOIL LEGEND

CULTURAL FEATURES

BOUNDARIES

County or parish	
Field sheet matchline & neatline	

AD HOC BOUNDARY (label)

Small airport, airfield, park, oilfield, cemetery	
---	--

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)	
--	--

ROADS

ROAD EMBLEMS & DESIGNATIONS

Federal	
State	

DAMS

Large (to scale)	
Medium or small	

PITS

Gravel pit	
------------	--

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)	
Church	
School	

WATER FEATURES

DRAINAGE

Intermittent	
Drainage end	
Canals or ditches	
Drainage and/or irrigation	

LAKES, PONDS AND RESERVOIRS

Perennial	
-----------	--

MISCELLANEOUS WATER FEATURES

Wet spot	
----------	--

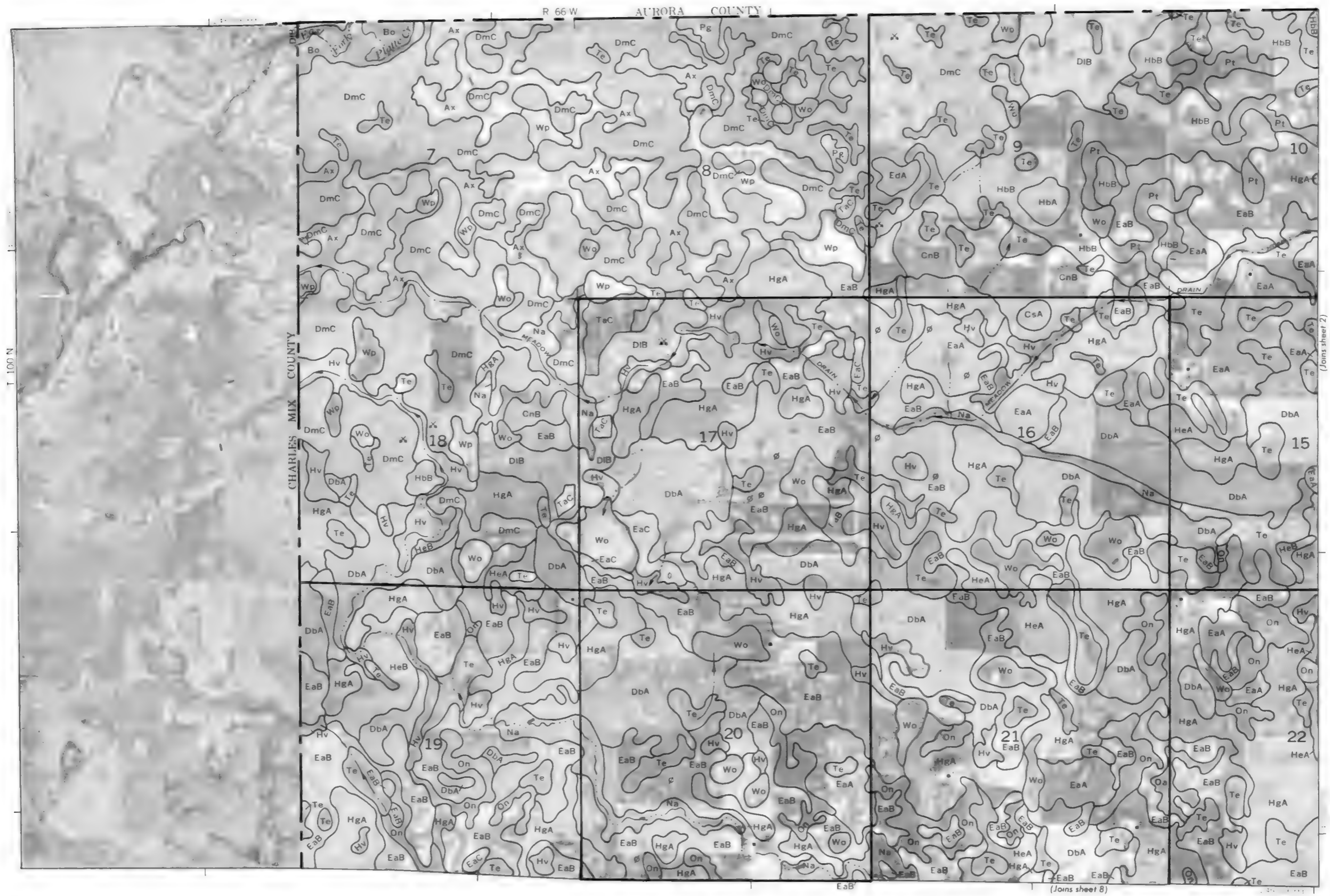
SPECIAL SYMBOLS FOR  
SOIL SURVEY

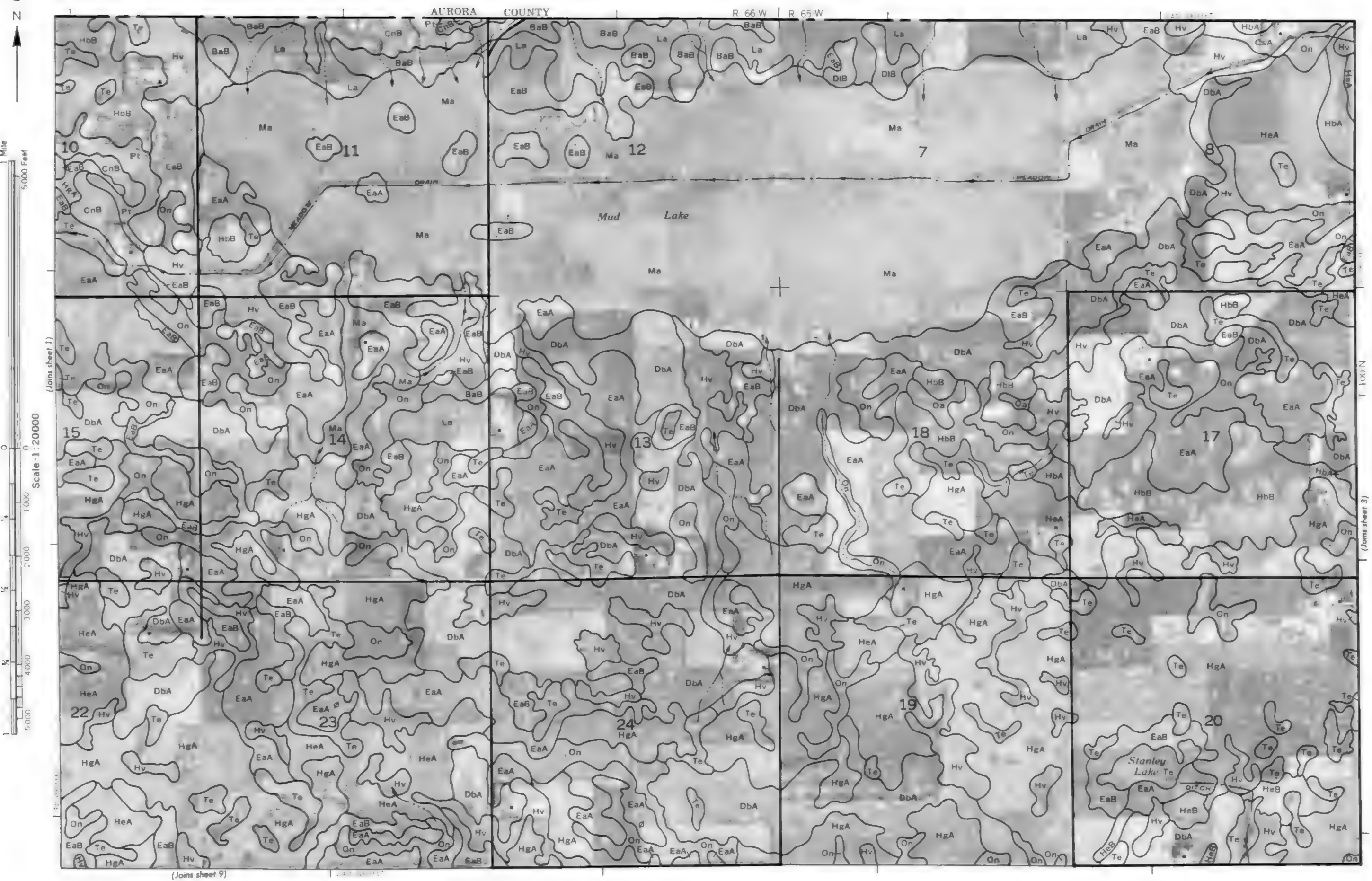
SOIL DELINEATIONS AND SYMBOLS

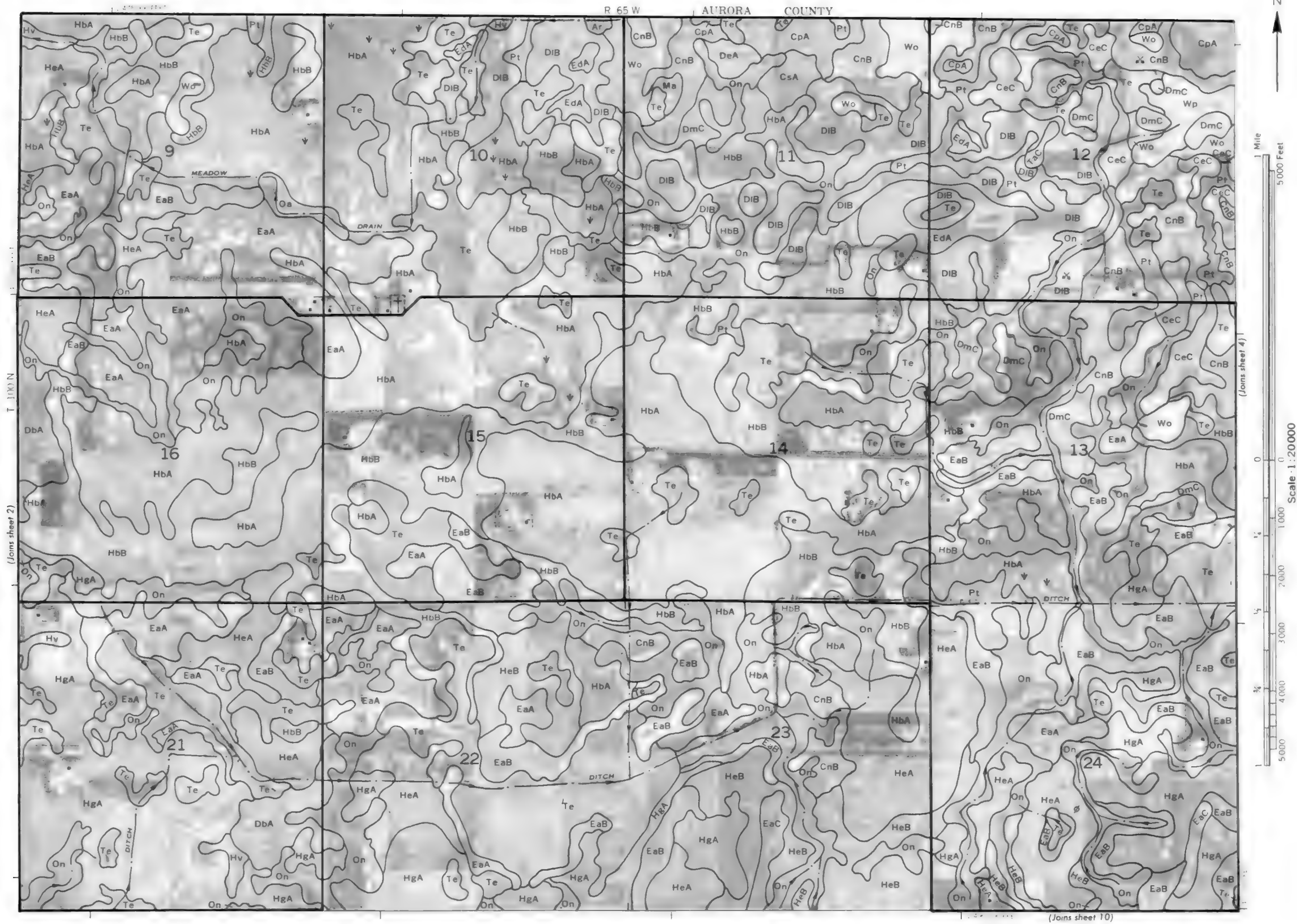
MISCELLANEOUS	
Gravelly spot	
Gumbo spot	
Sandy spot	
Stony spot, very stony spot	

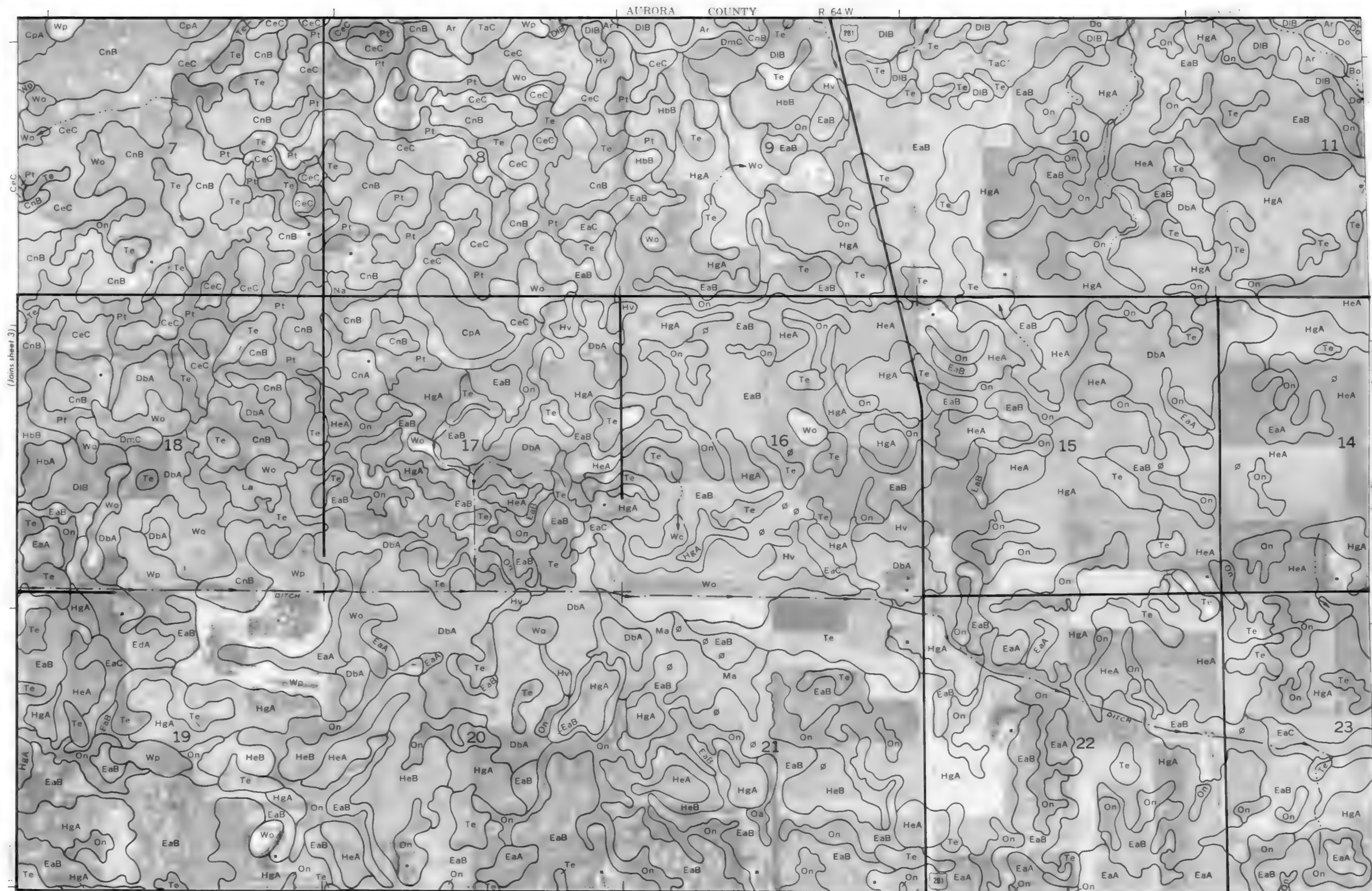
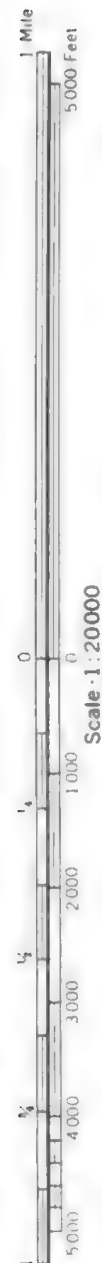
Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter except that it does not separate sloping phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
A	Arlo loam
A <sub>w</sub>	Arlo loam wet
BaB	Beadle clay loam 2 to 6 percent slopes
BeE	Betts-Ethan loams 15 to 40 percent slopes
Bn	Bon loam
Bo	Bon loam channeled
CeC	Clarno-Ethan loams 6 to 9 percent slopes
CnA	Clarno-Ethan-Prosper loams 0 to 3 percent slopes
CnB	Clarno-Ethan-Prosper loams 1 to 6 percent slopes
CpA	Clarno-Prosper loams 0 to 2 percent slopes
CsA	Clarno-Stickney-Prosper loams 0 to 3 percent slopes
DaB	Davis silt loam 2 to 6 percent slopes
DeA	DeGrey-Walke silt loams 0 to 4 percent slopes
DeA	Delmont loam 0 to 2 percent slopes
DeB	Delmont-Enet loams 2 to 6 percent slopes
DmC	Delmont-Talmo loams 2 to 9 percent slopes
Dm	Dmo loam
EaA	Eakin-Ethan complex 0 to 3 percent slopes
EaB	Eakin-Ethan complex 3 to 6 percent slopes
EaC	Eakin-Ethan complex 6 to 9 percent slopes
EdA	Enet-Delmont loams 0 to 2 percent slopes
EtD	Ethan-Clarno loams 9 to 15 percent slopes
Fa	Farmsworth silt loam
HbA	Henkin-Bendon fine sandy loams 0 to 2 percent slopes
HbB	Henkin-Bendon fine sandy loams 2 to 6 percent slopes
HeA	Highmore-Eakin silt loams 0 to 2 percent slopes
HeB	Highmore-Eakin silt loams 2 to 6 percent slopes
HgA	Highmore-Walke silt loams 0 to 3 percent slopes
HmB	Homme silty clay loam 2 to 6 percent slopes
HmB	Homme-Ethan complex 1 to 6 percent slopes
HnA	Homme-Onita silty clay loams 0 to 2 percent slopes
Hv	Hoven silt loam
La	Lane silty clay loam
Ma	Macken silty clay
Na	Napa silt loam
On	Onita silt loam
On	Onita-Tetonka silt loams
Pg	Pits gravel
Pr	Prosper-Tetonka complex
TaC	Talmo gravelly sandy loam 2 to 9 percent slopes
Te	Tetonka silt loam
Wc	Worthing silty clay loam
Wo	Worthing silty clay loam ponded

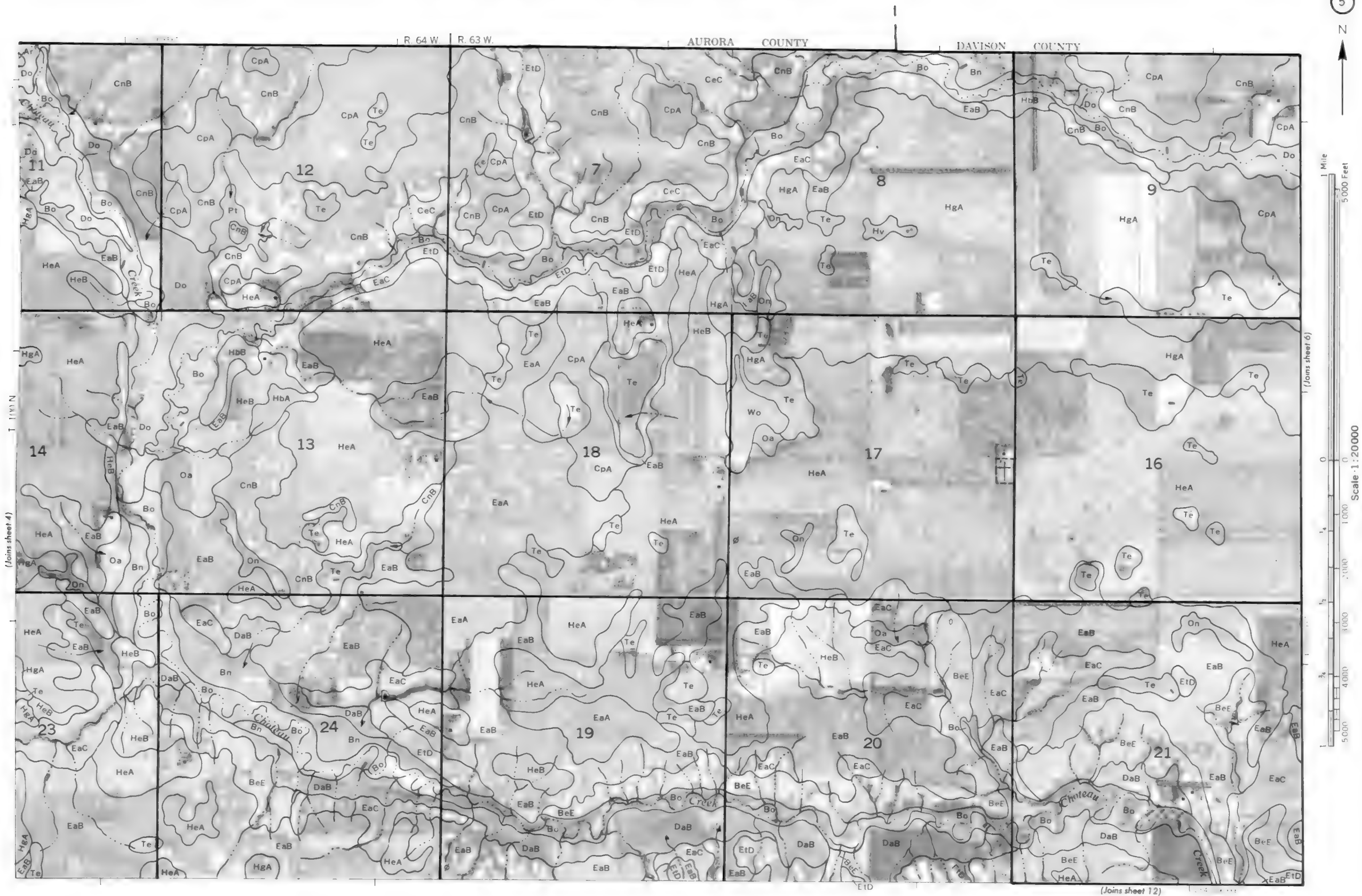








N





DAVISON COUNTY

R 63 W | R 62 W



(Joins sheet 5)

Scale 1:20,000

(Joins sheet 7)

(Joins sheet 13)



(Joins sheet 6)

(Joins sheet 14)

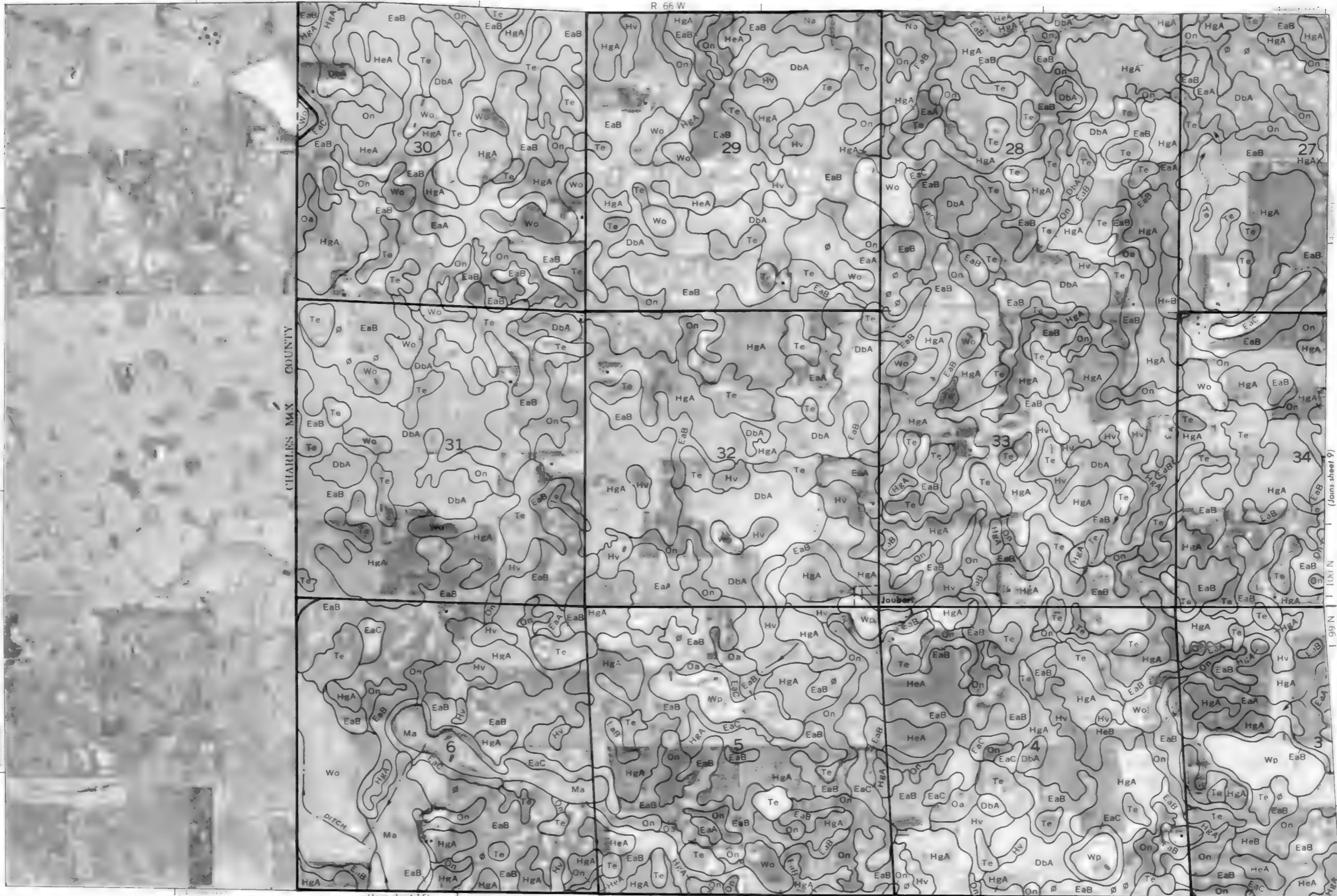


(Joins sheet 1)

R 66 W

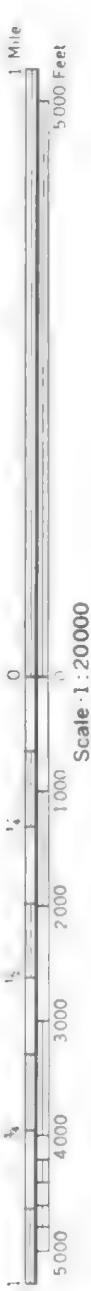


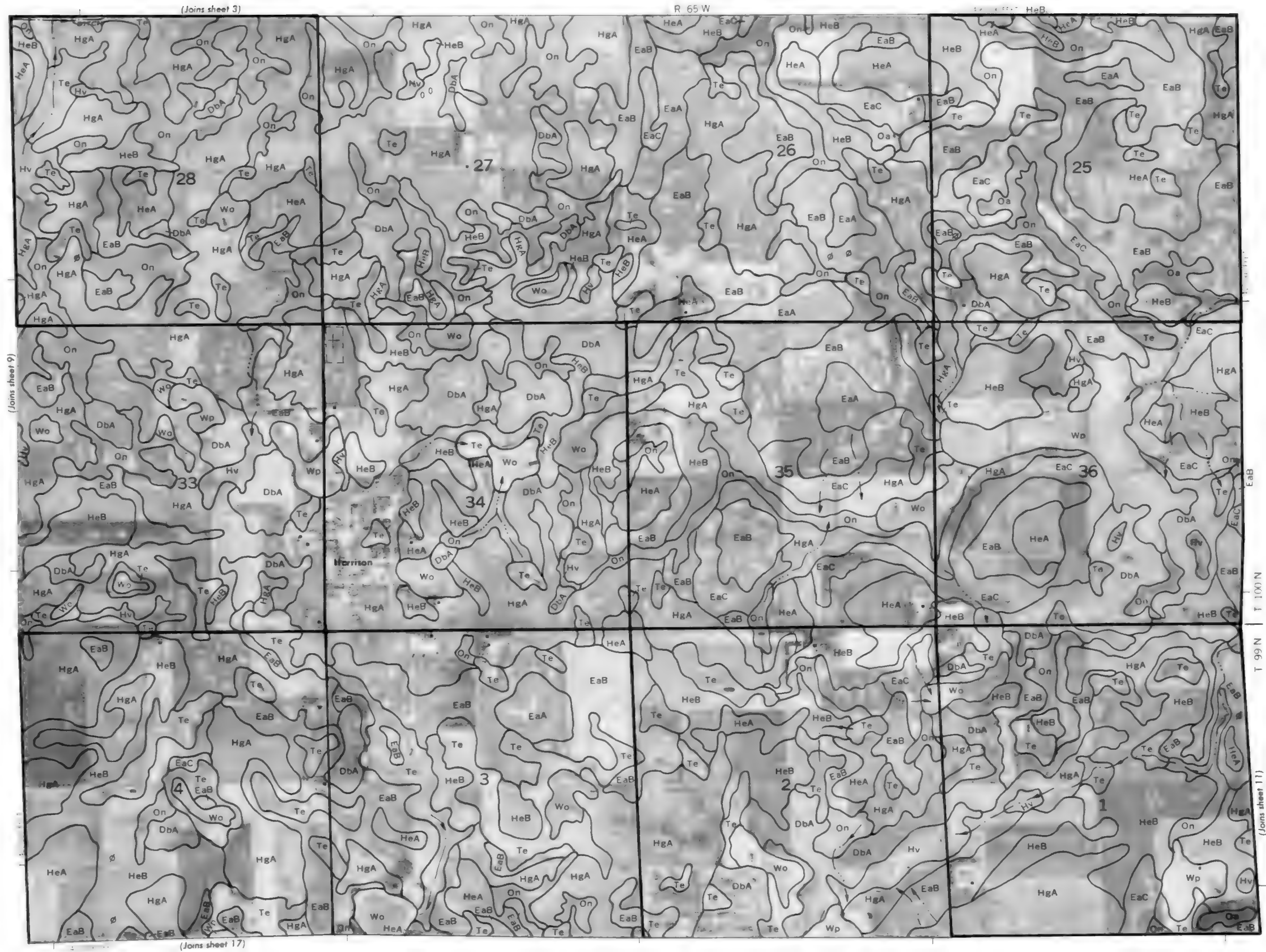
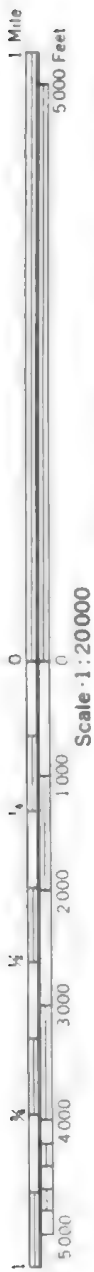
CHARLES MIX COUNTY

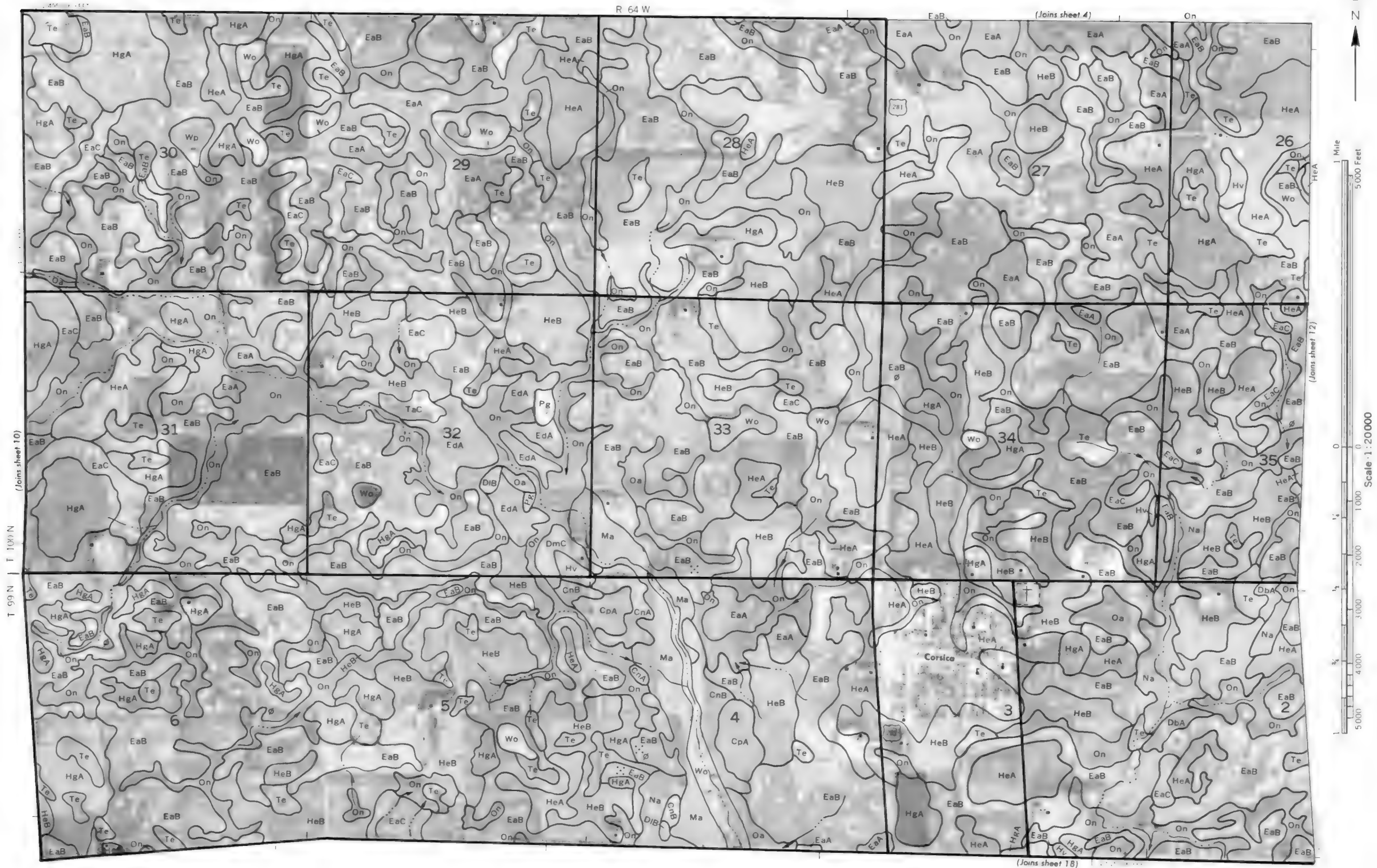


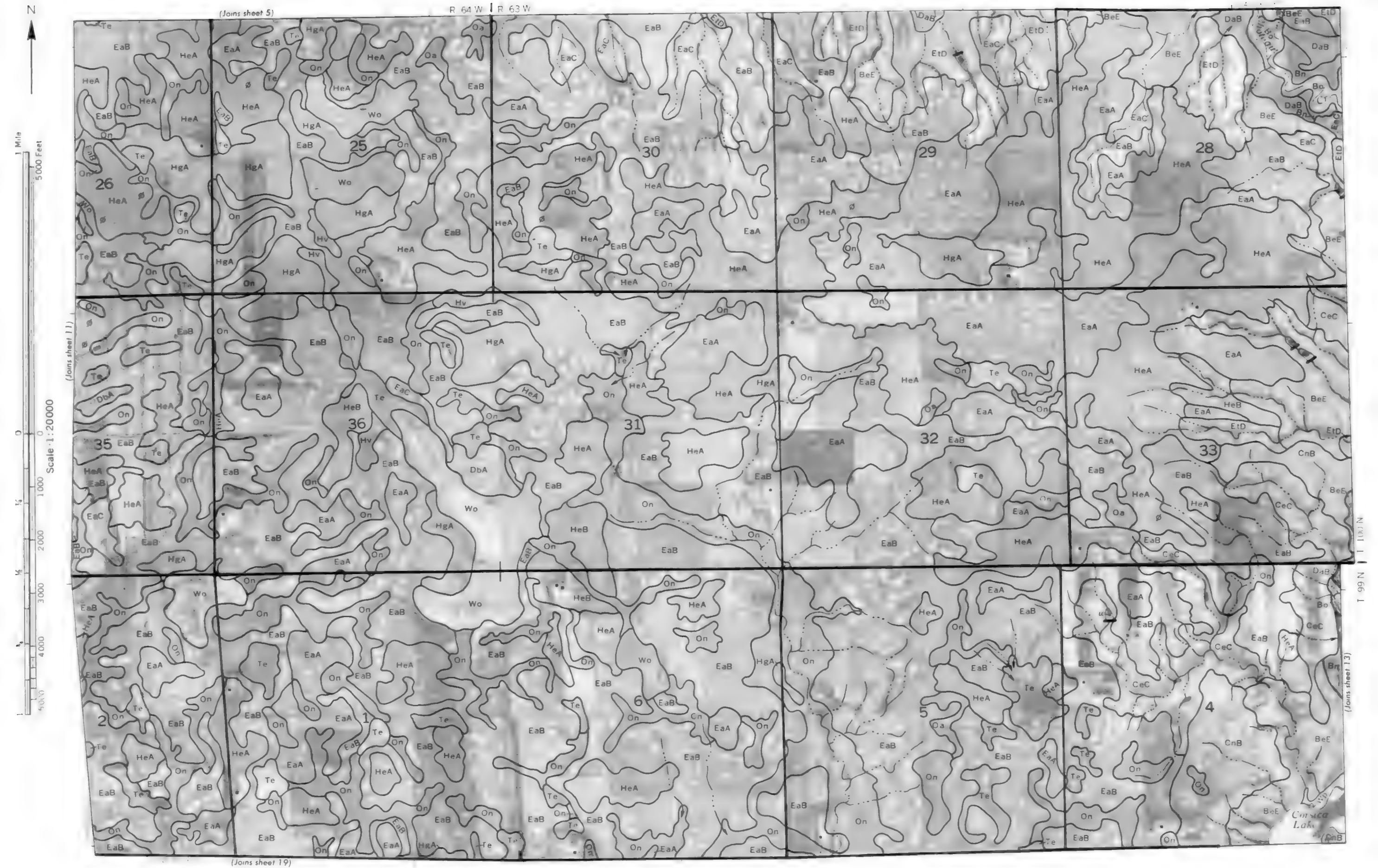
(Joins sheet 15)

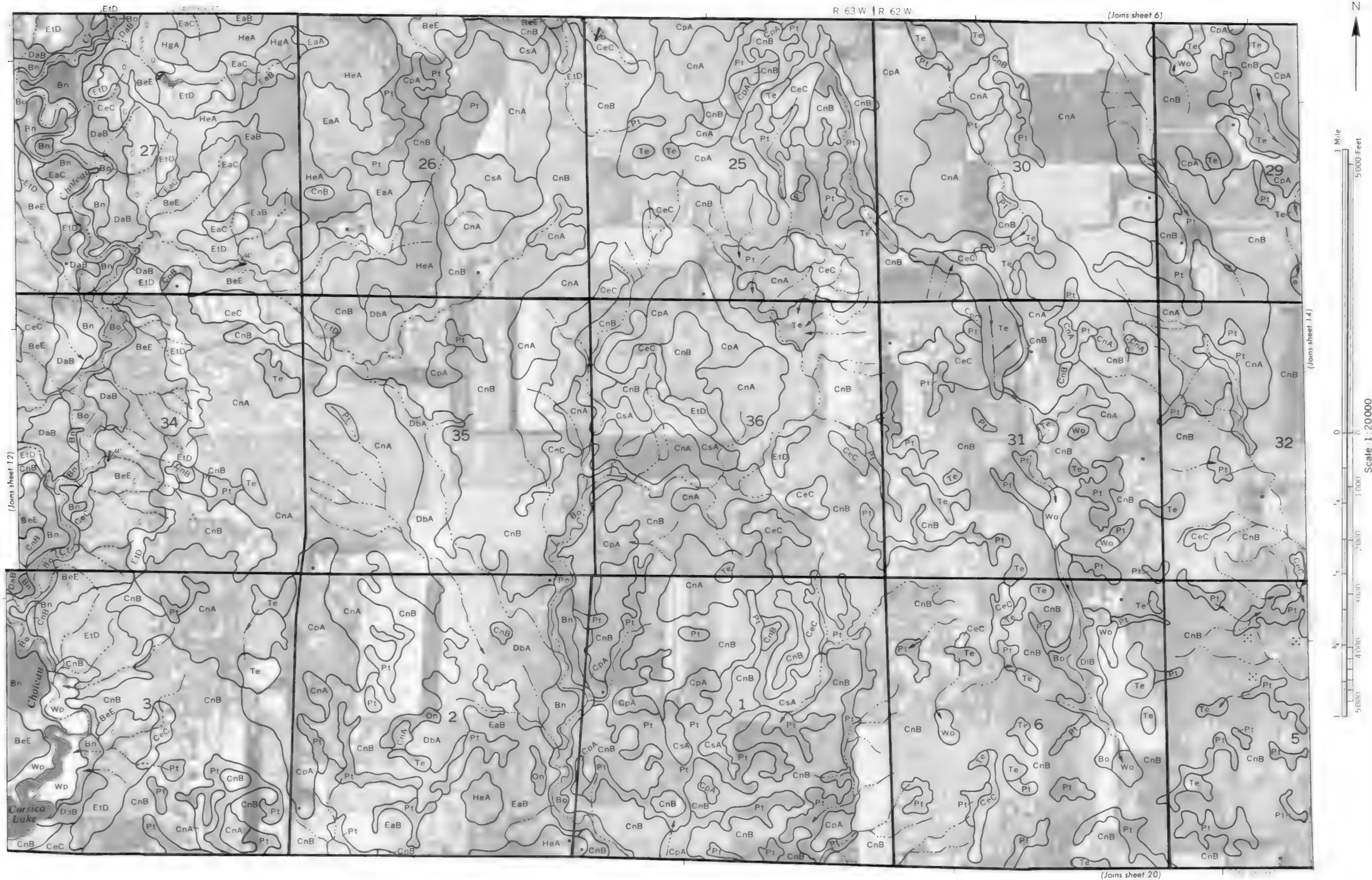
(Joins sheet 9)













1 Mile  
5000 Feet

(Joins sheet 7)

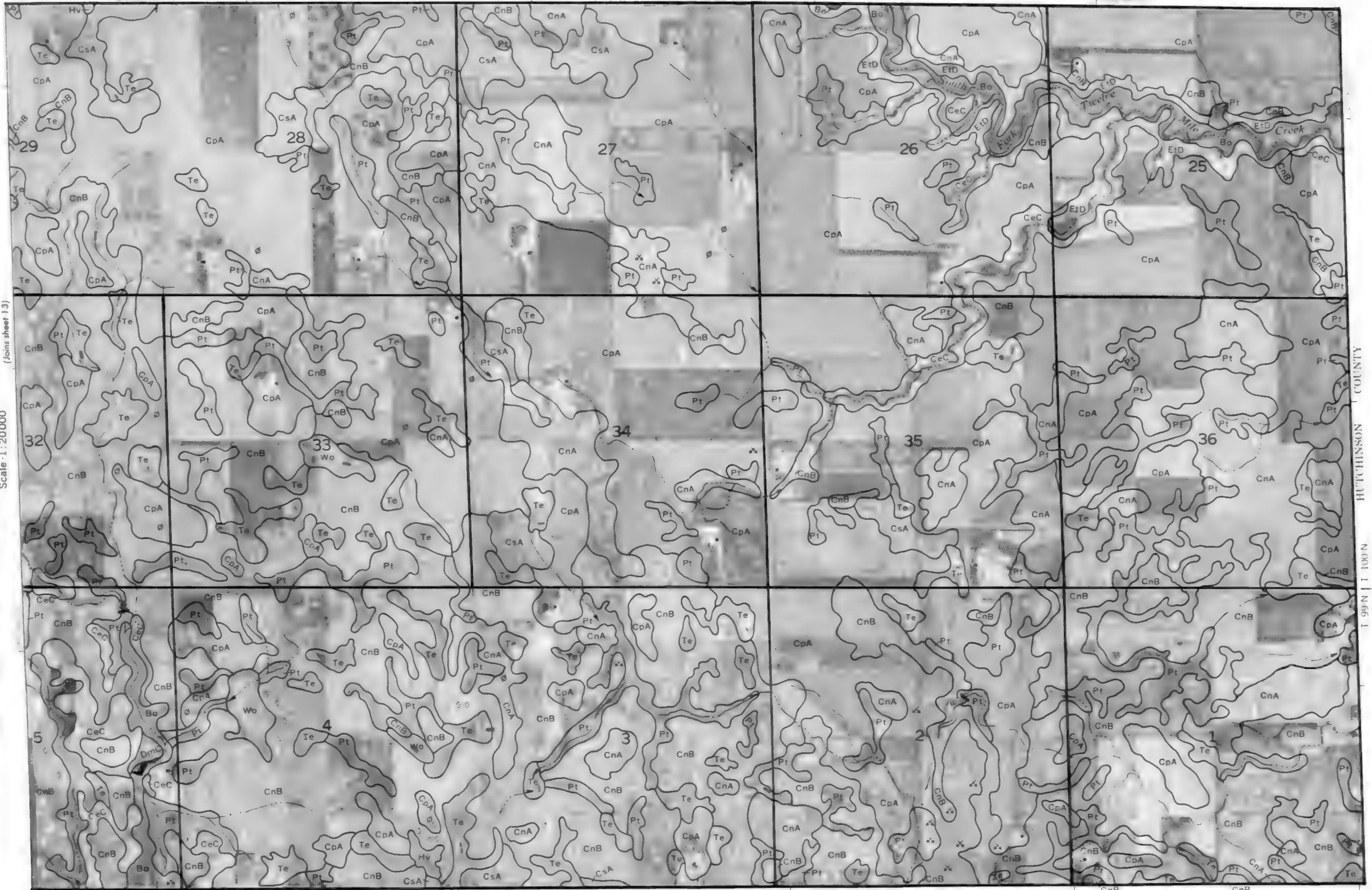
Scale 1:20000

(Joins sheet 13)

0 1000 2000 3000 4000 5000

(Joins sheet 7)

R 62 W



(Joins sheet 21)

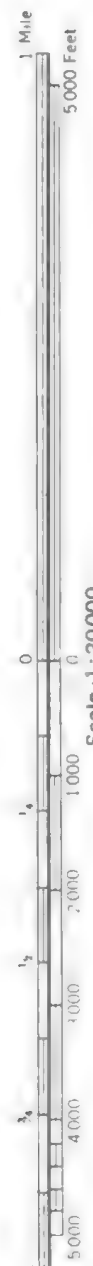
HUTCHINSON COUNTY

T 99 N



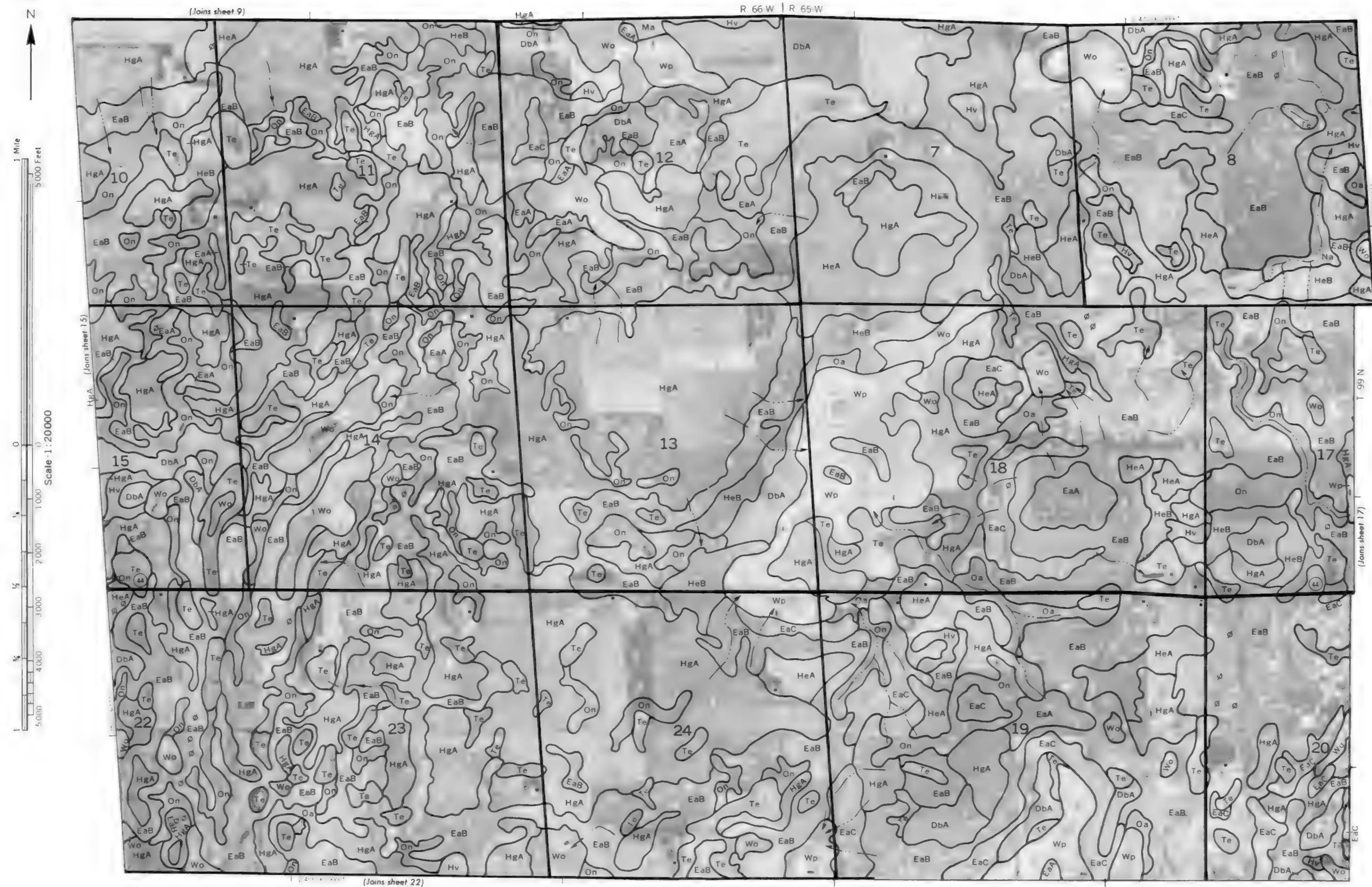
(Joins sheet 8)

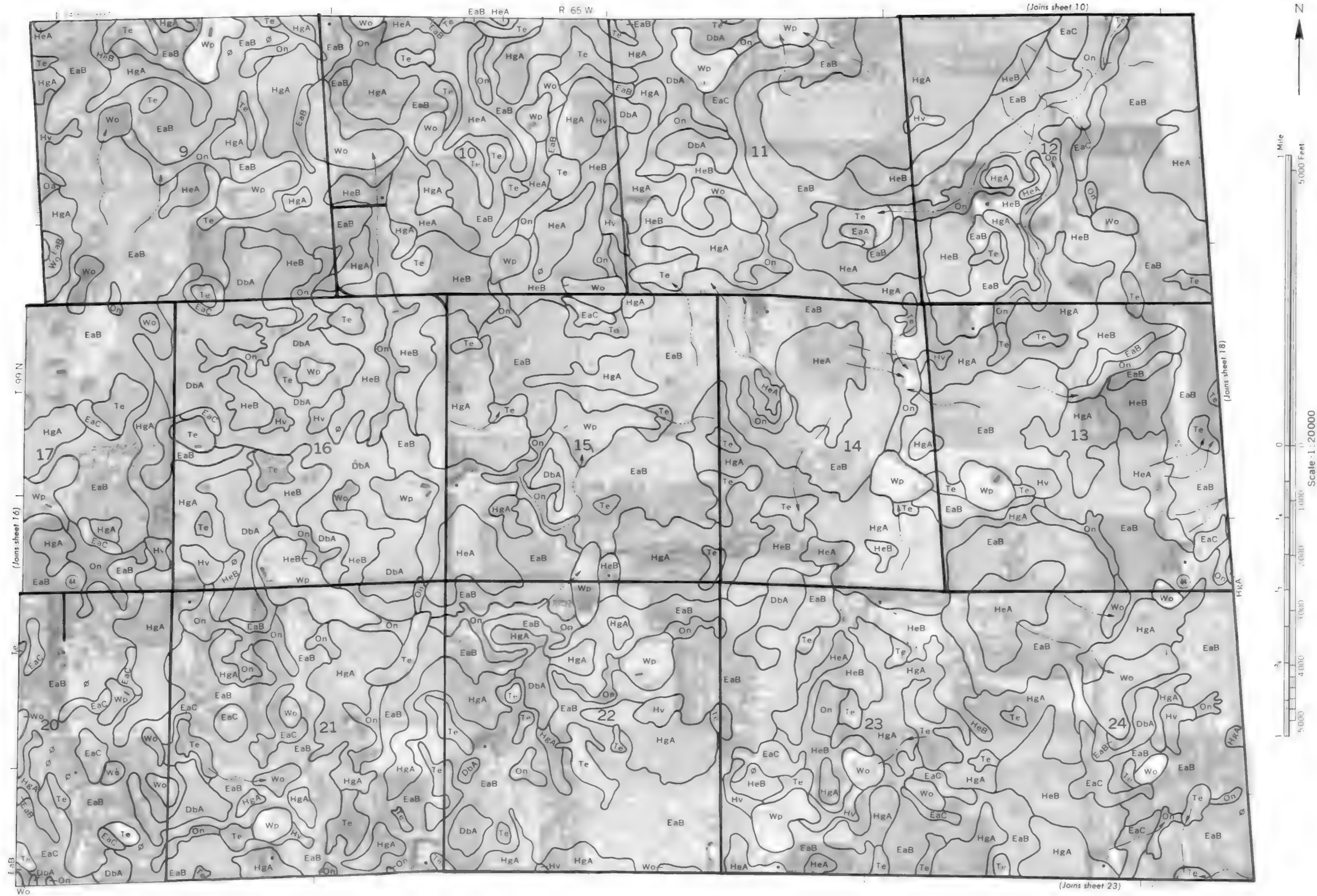
R 66 W



CHARLES MIX COUNTY

(Joins inset, sheet 22)





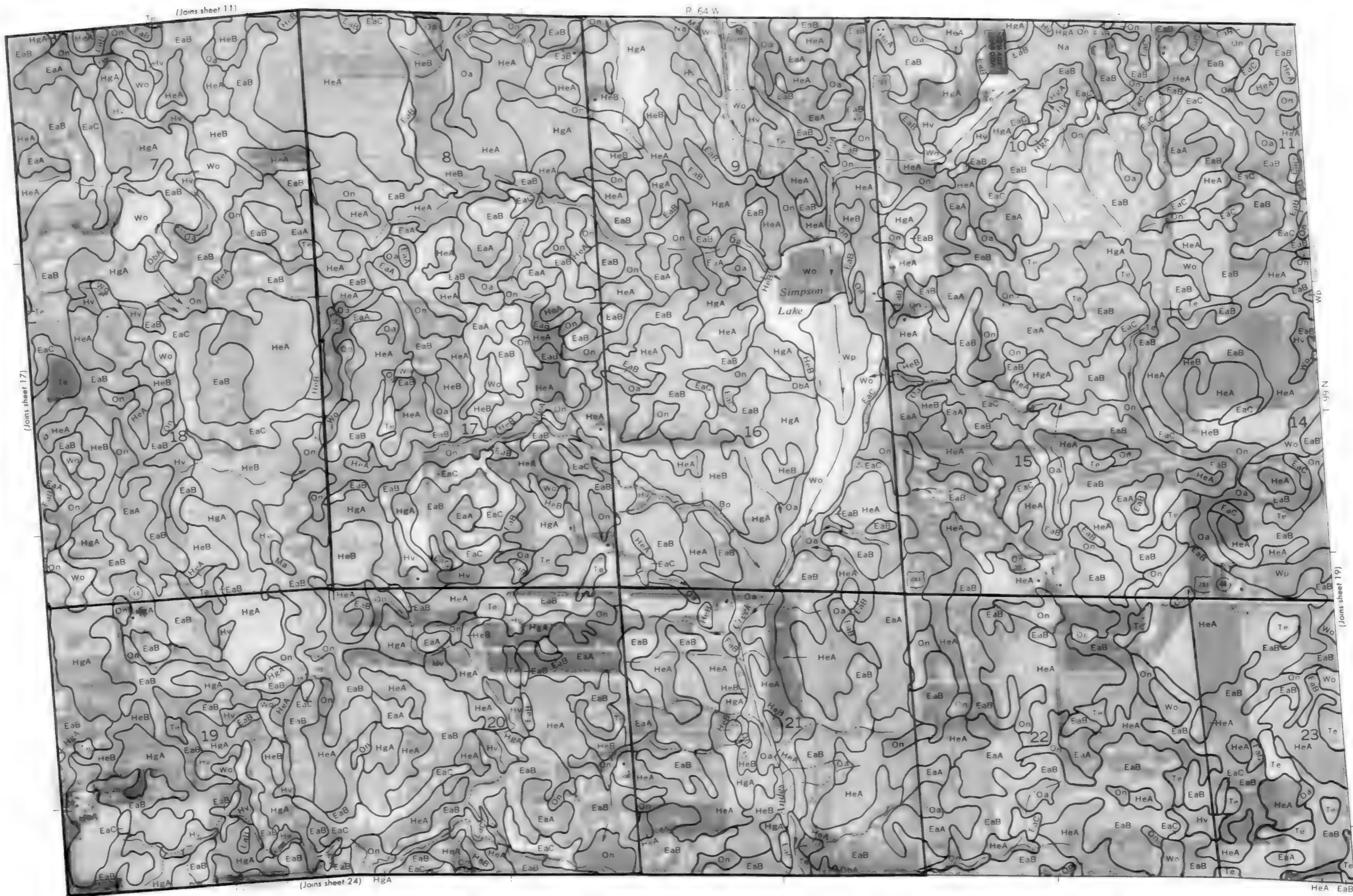
(Joins sheet 11)

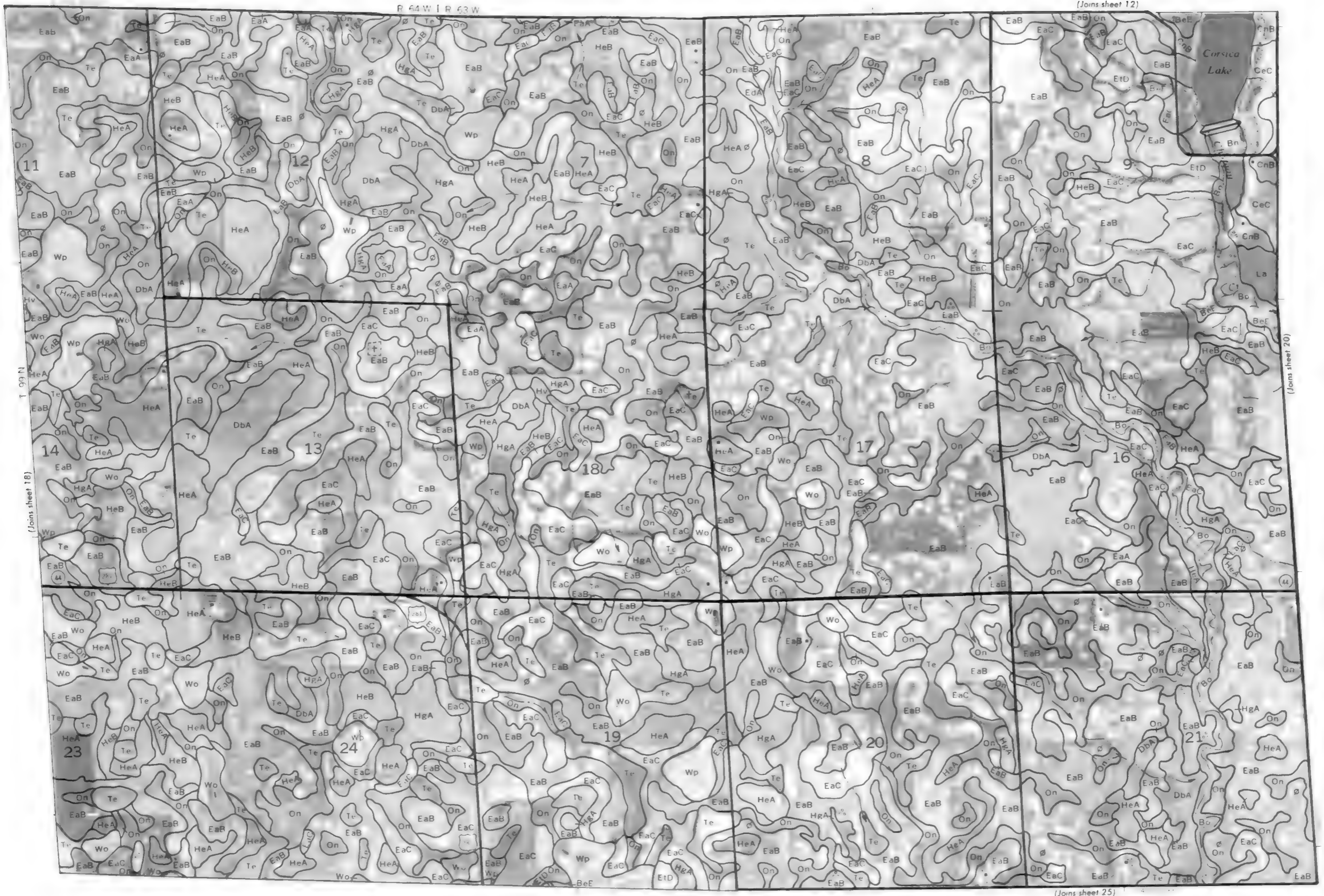
R 64 W



1 Mile  
5,000 Feet

Scale 1:20000

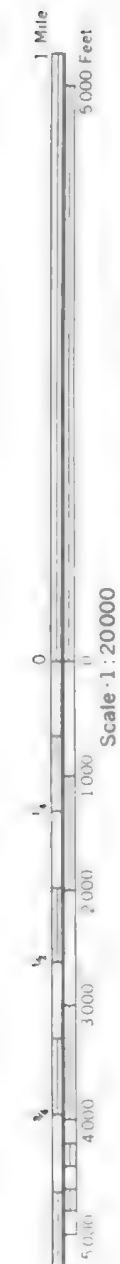






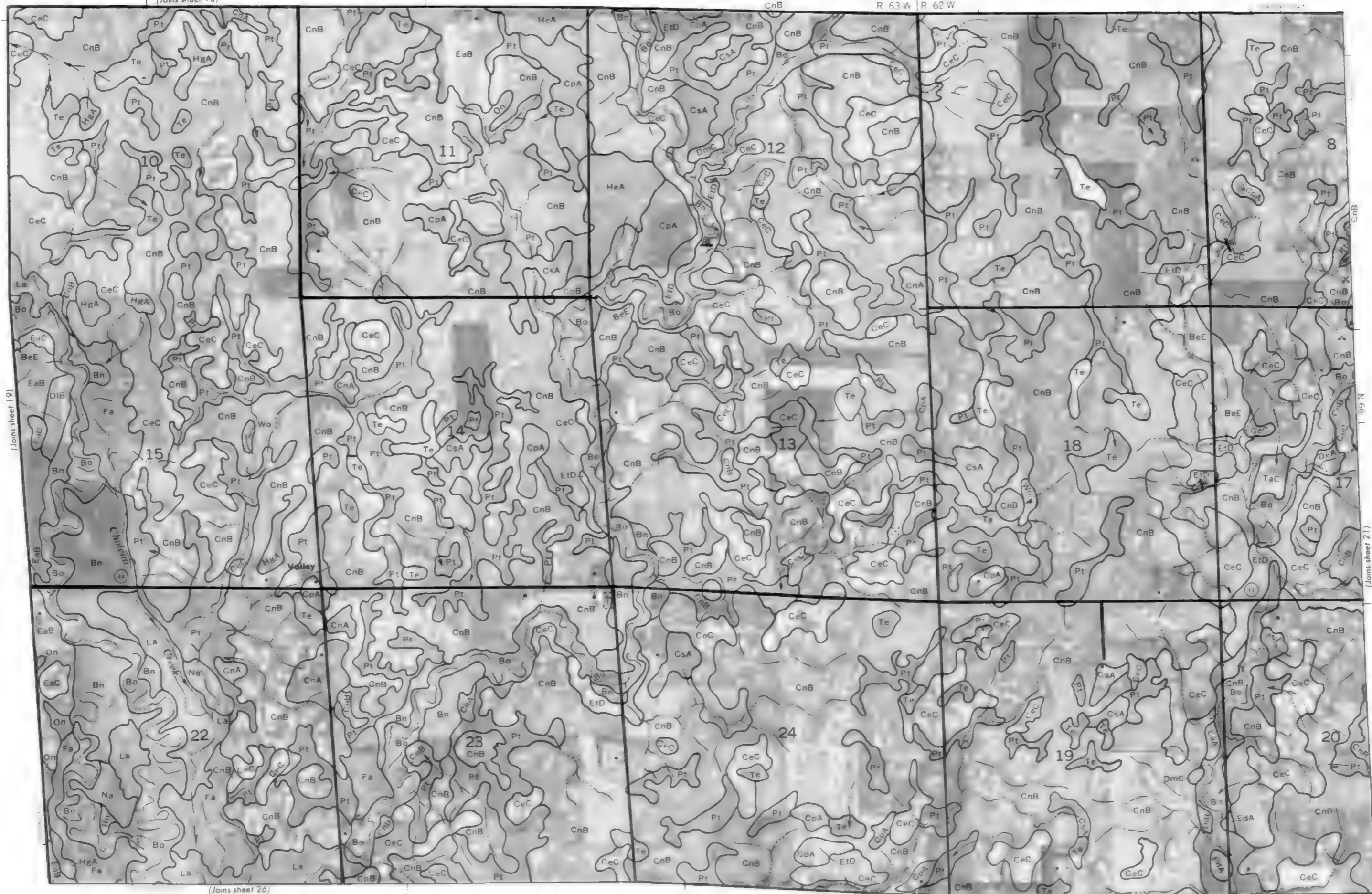
(Joins sheet 13)

R 63 W | R 62 W

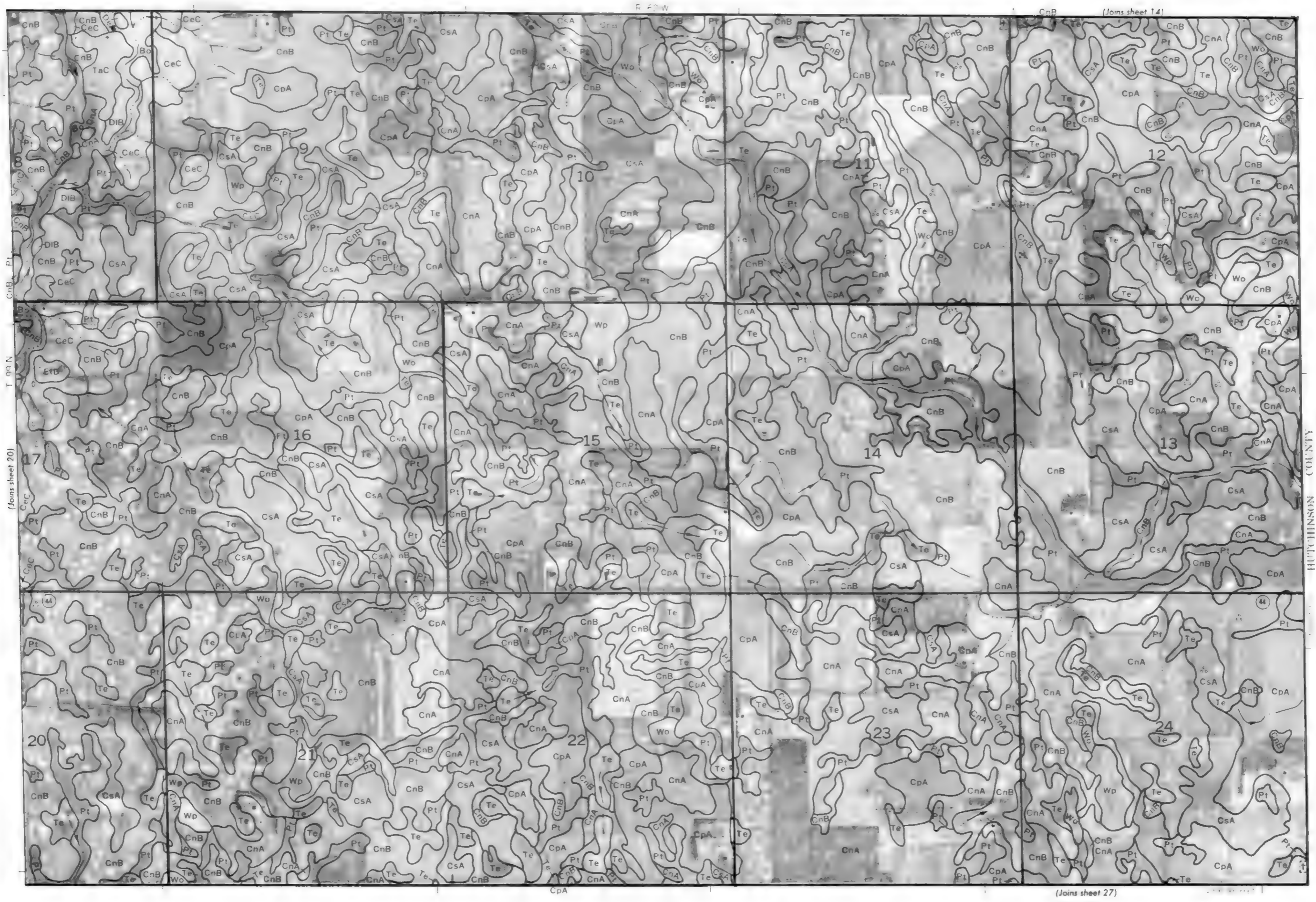


(Joins sheet 19)

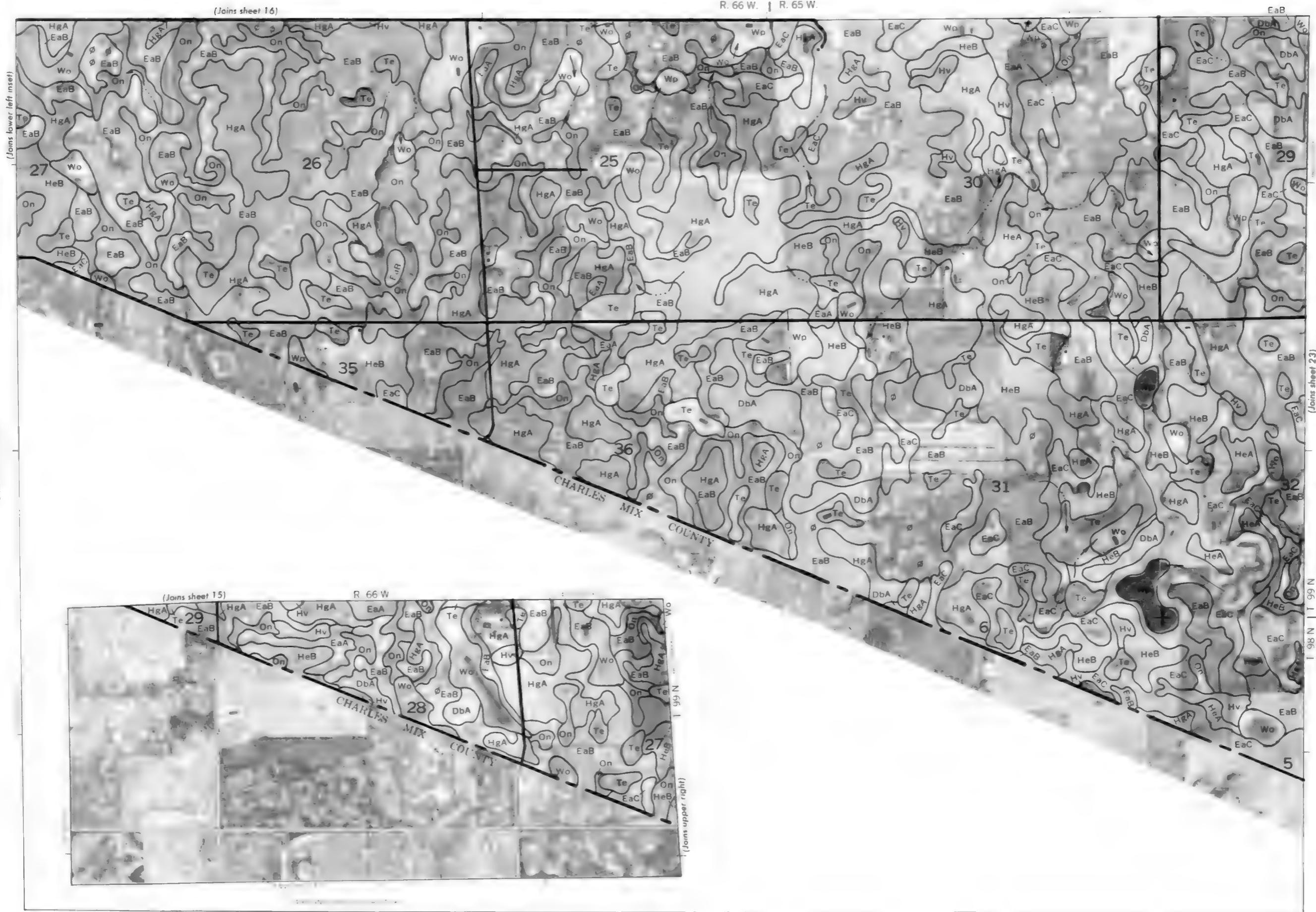
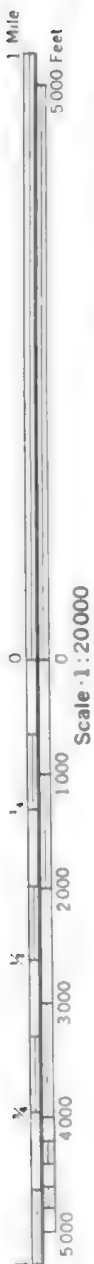
(Joins sheet 26)



(Joins sheet 21)



R. 66 W. | R. 65 W.



(Joins sheet 17)



Scale 1:20000

(Joins sheet 18)

R 64 W



1 Mile  
5,000 Feet

Scale 1:20000

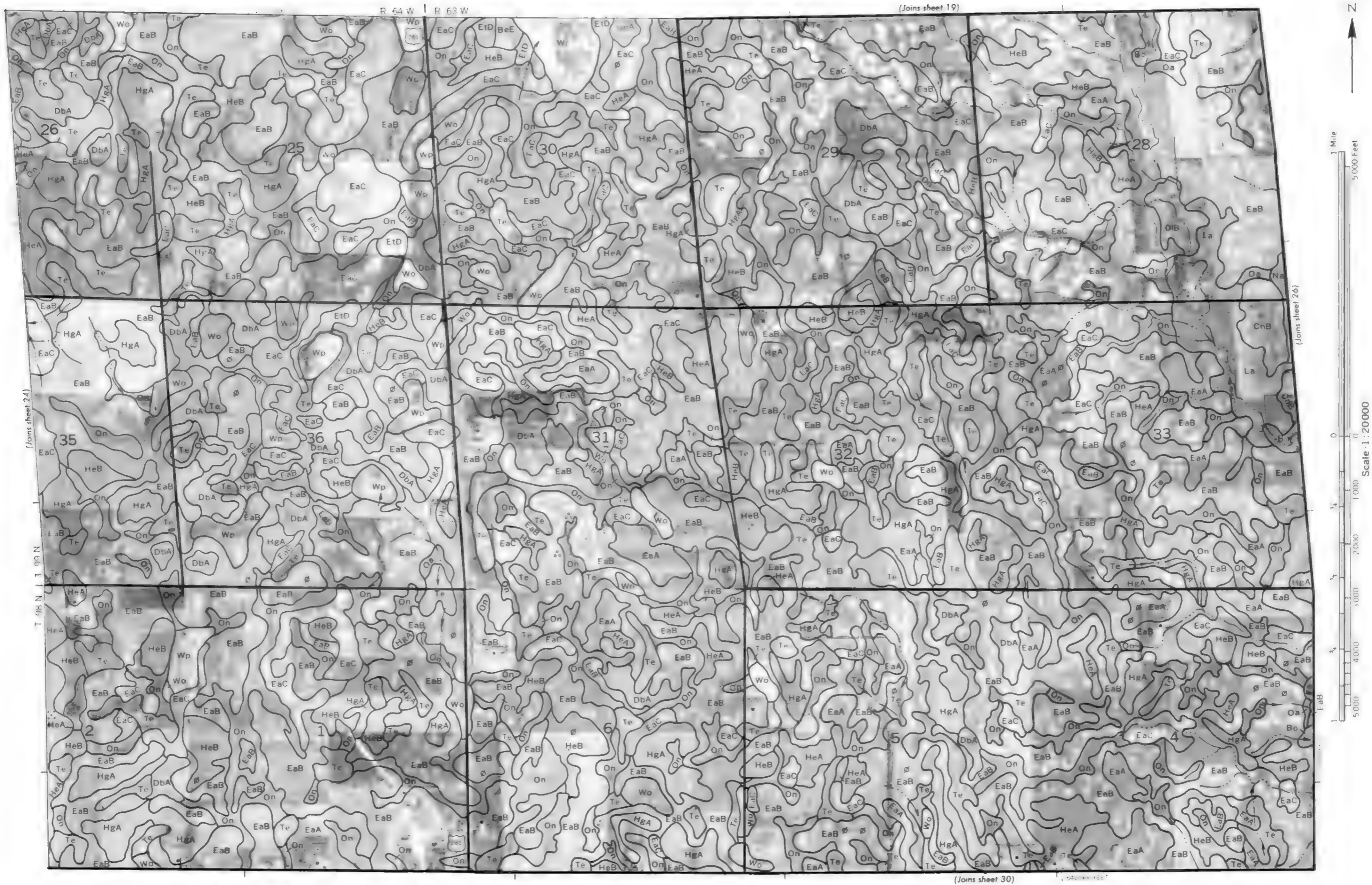
(Joins sheet 23)

(Joins sheet 25)

T 99 N  
T 98 N

(Joins sheet 29)

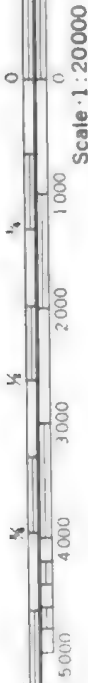




R 63 W | R 62 W

1 Mile  
5000 Feet

Scale: 1:20000

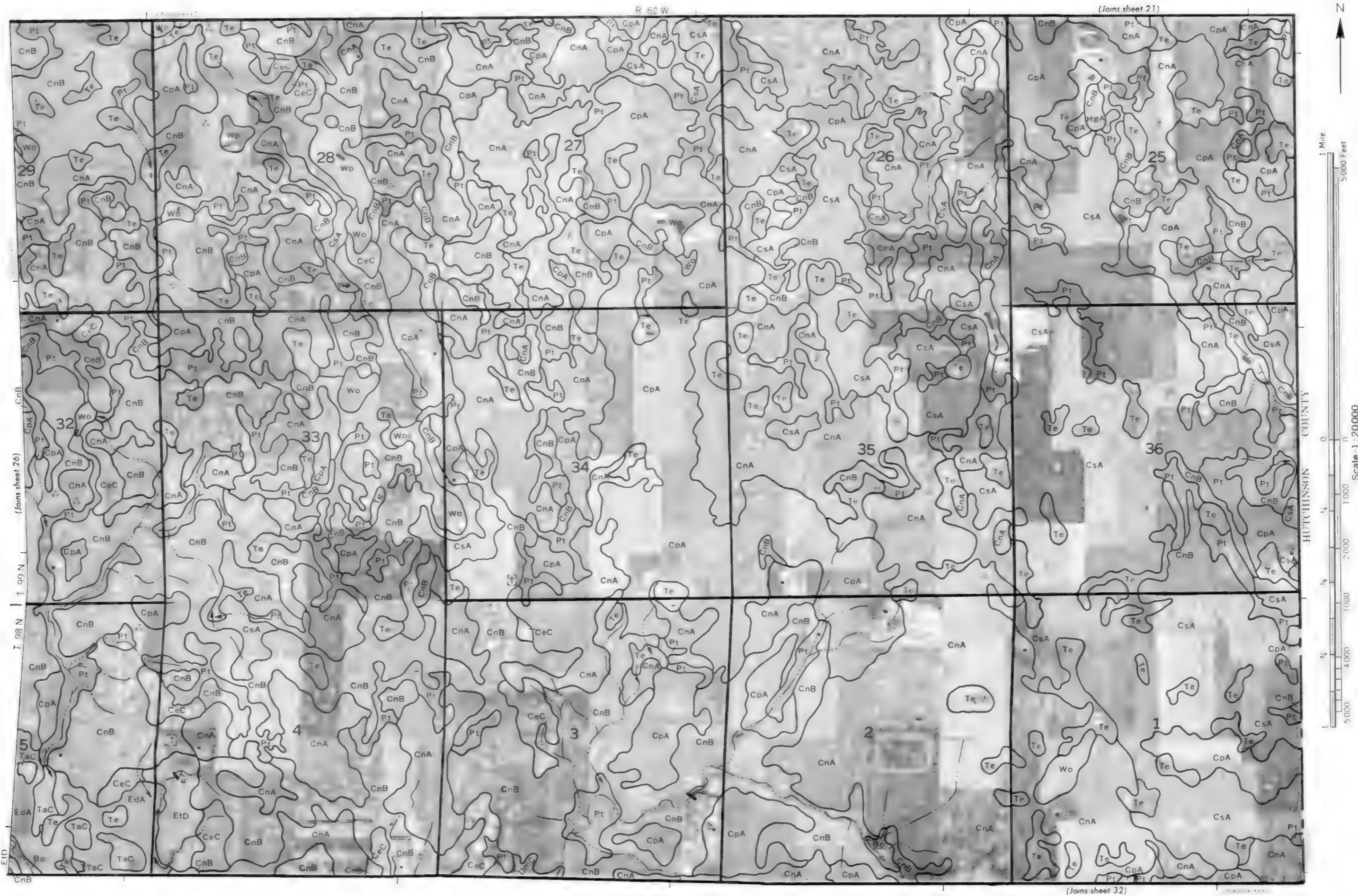


(Joins sheet 31)

(Joins sheet 27)

1 99 N

1.98 N



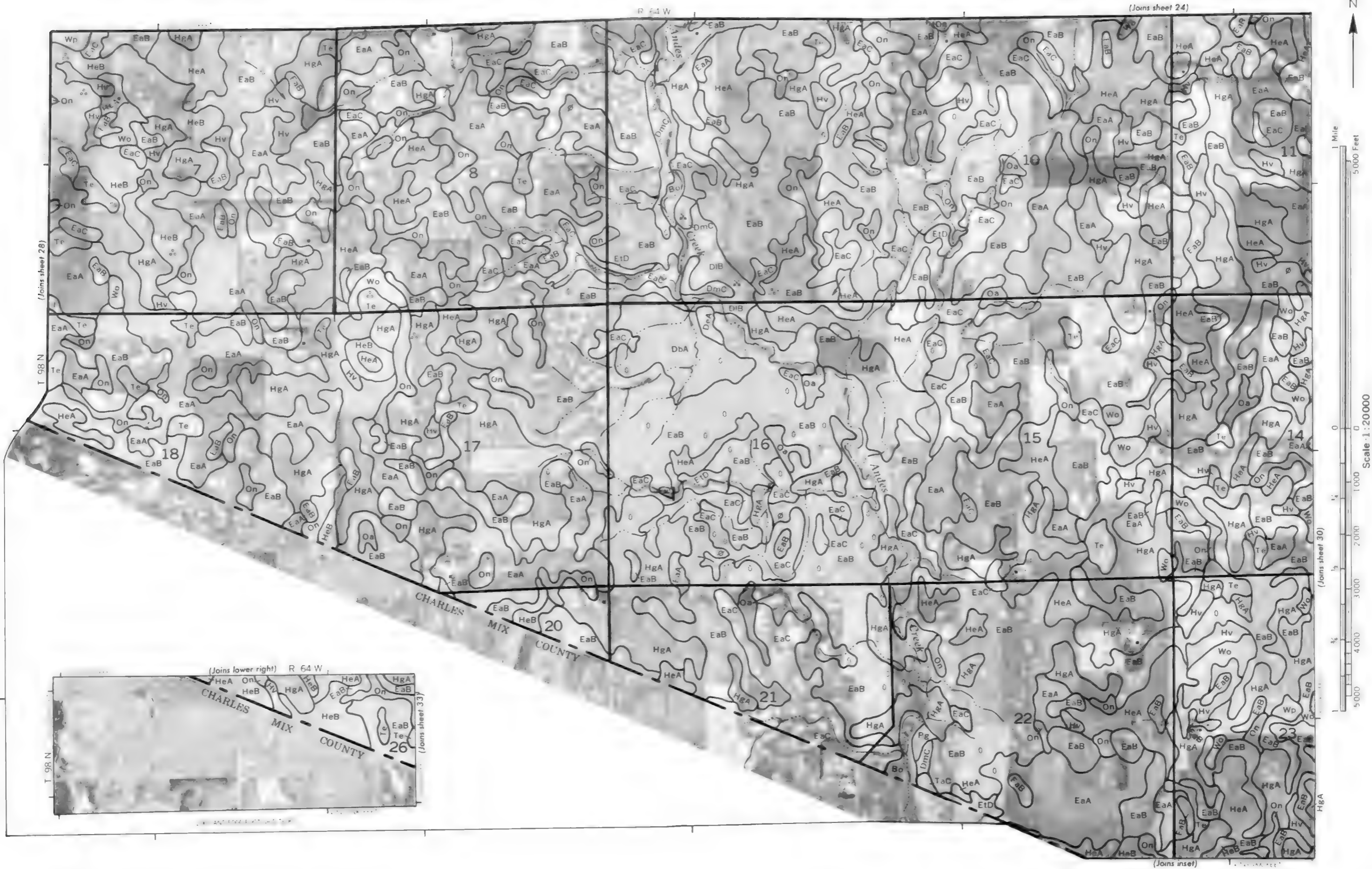


1 Mile  
5,000 Feet

Scale 1:20,000

5,000  
4,000  
3,000  
2,000  
1,000  
0





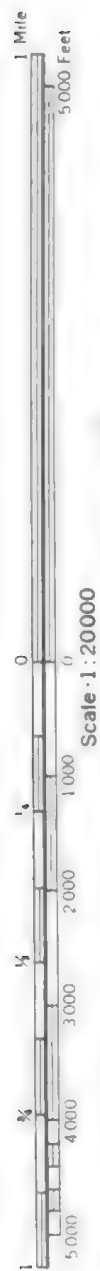
30



(Joins sheet 25)

R 64 W | R 63 W

On



(Joins sheet 29)

Scale 1:20000

T 98 N

(Joins sheet 31)



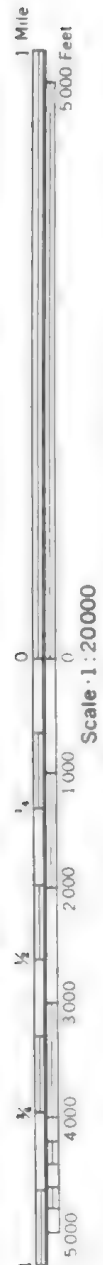
(Joins sheet 33)





(Joins sheet 27)

R 62 W



(Joins sheet 35)



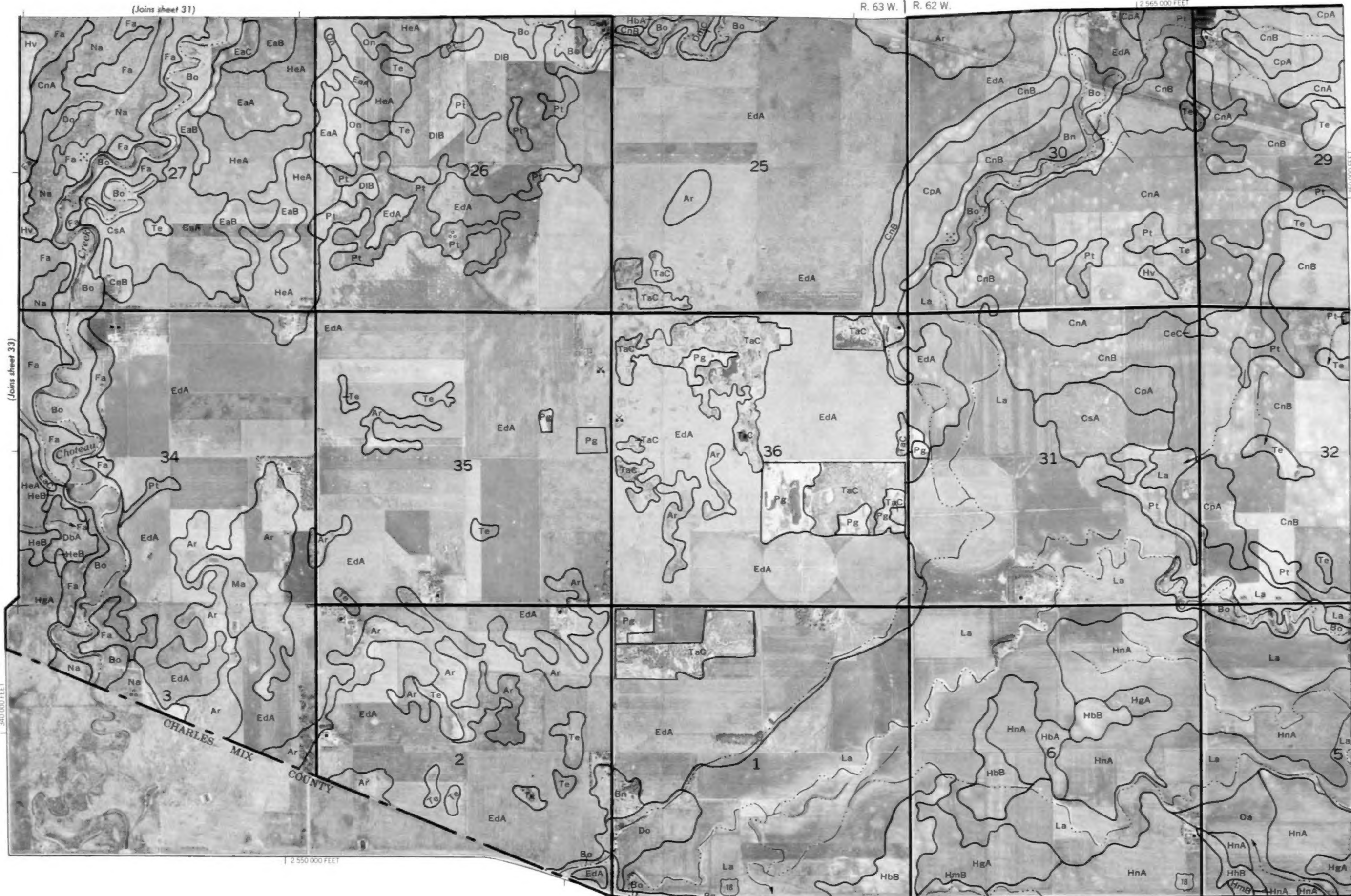
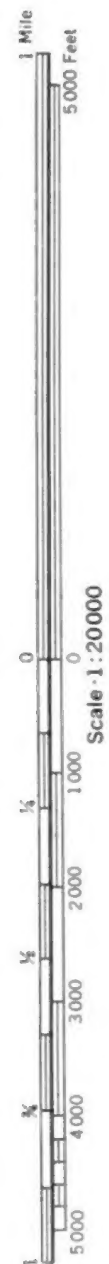
34



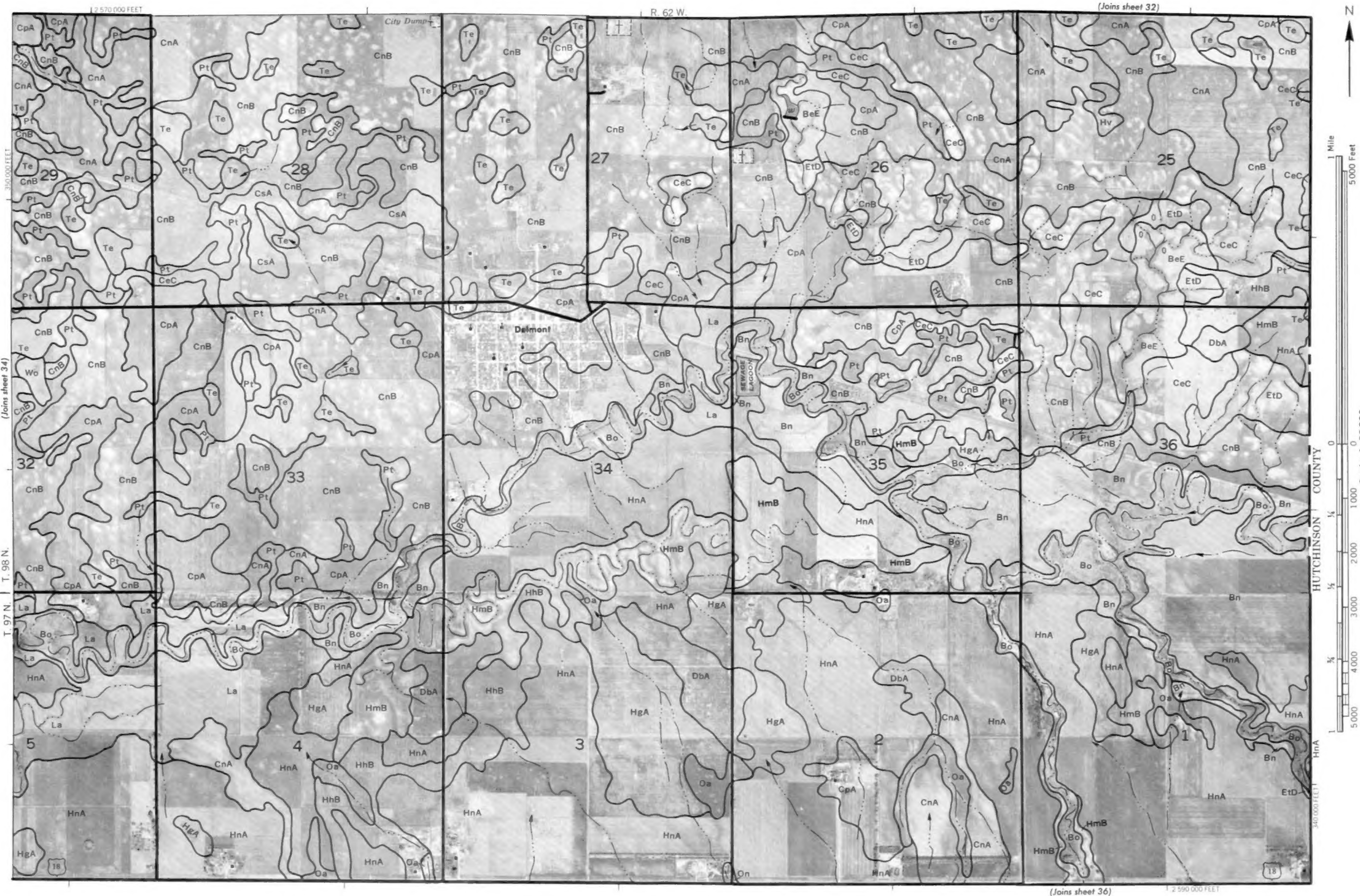
(Joins sheet 31)

R. 63 W. | R. 62 W.

12 565 000 FEET



(Joins inset, sheet 33)



2 590 000 FEET

(Joins inset, sheet 33)

Scale · 1 : 20 000

325 000 FEET

2 570 000 FEET

1335 000 FEET

T. 97 N.

HITCHINSON COUNTY

HmB